US 60|US 70|US 191 CORRIDOR PROFILE STUDY

FLORENCE JUNCTION (SR 79) TO DOUGLAS

ADOT Work Task No. MPD-029-16
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Draft Working Paper 4: Performance-Based Needs Assessment

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LIST OF ABBREVIATIONS

Abbreviation	Name
ADOT	Arizona Department of Transportation
ADT	Average Daily Traffic
AGFD	Arizona Game and Fish Department
AZER	Arizona Eastern Railroad
BCA	Benefit Cost Analysis
CCTV	Closed Circuit Television
DMS	Dynamic Message Signs
F+I	Fatal and Incapacitating
HPMS	Highway Performance Monitoring System
I	Interstate
LCCA	Life Cycle Cost Analysis
LRTP	Long Range Transportation Plan
MP	Milepost
MPD	Multimodal Planning Division
NBI	National Bridge Inspection
P2P	Planning to Programming Linkage
PDI	Pavement Distress Index
POE	Port of Entry
PSR	Pavement Serviceability Rating
PTI	Planning Time Index
SHSP	Strategic Highway Safety Plan
SOV	Single Occupancy Vehicle
SR	State Route
SWAP	State Wildlife Action Plan
TAC	Technical Advisory Committee
TTI	Travel Time Index
TPTI	Truck Planning Time Index
TTTI	Truck Travel Time Index
U.S.	United States
V/C	Volume to Capacity

1.0 INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study of US Route 60|US 70: SR 79 to US 191 and US 191: US 70 to SR 80 (US 60|US 70|US 191). This study will look at key performance measures relative to the US 60|US 70|US 191 corridor, and the results of this performance evaluation will be used to identify potential strategic improvements.

The intent of the corridor profile program, and of the Planning to Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network. ADOT is conducting eleven corridor profile studies. The eleven corridors are being evaluated within three separate groupings.

The first three studies (Round 1) began in spring 2014, and encompass:

- I-17: SR 101L to I-40
- I-19: Mexico International Border to I-10
- I-40: California State Line to I-17

The second round (Round 2) of studies, initiated in spring 2015, includes:

- I-8: California State Line to I-10
- I-40: I-17 to the New Mexico State Line
- SR 95: I-8 to I-40

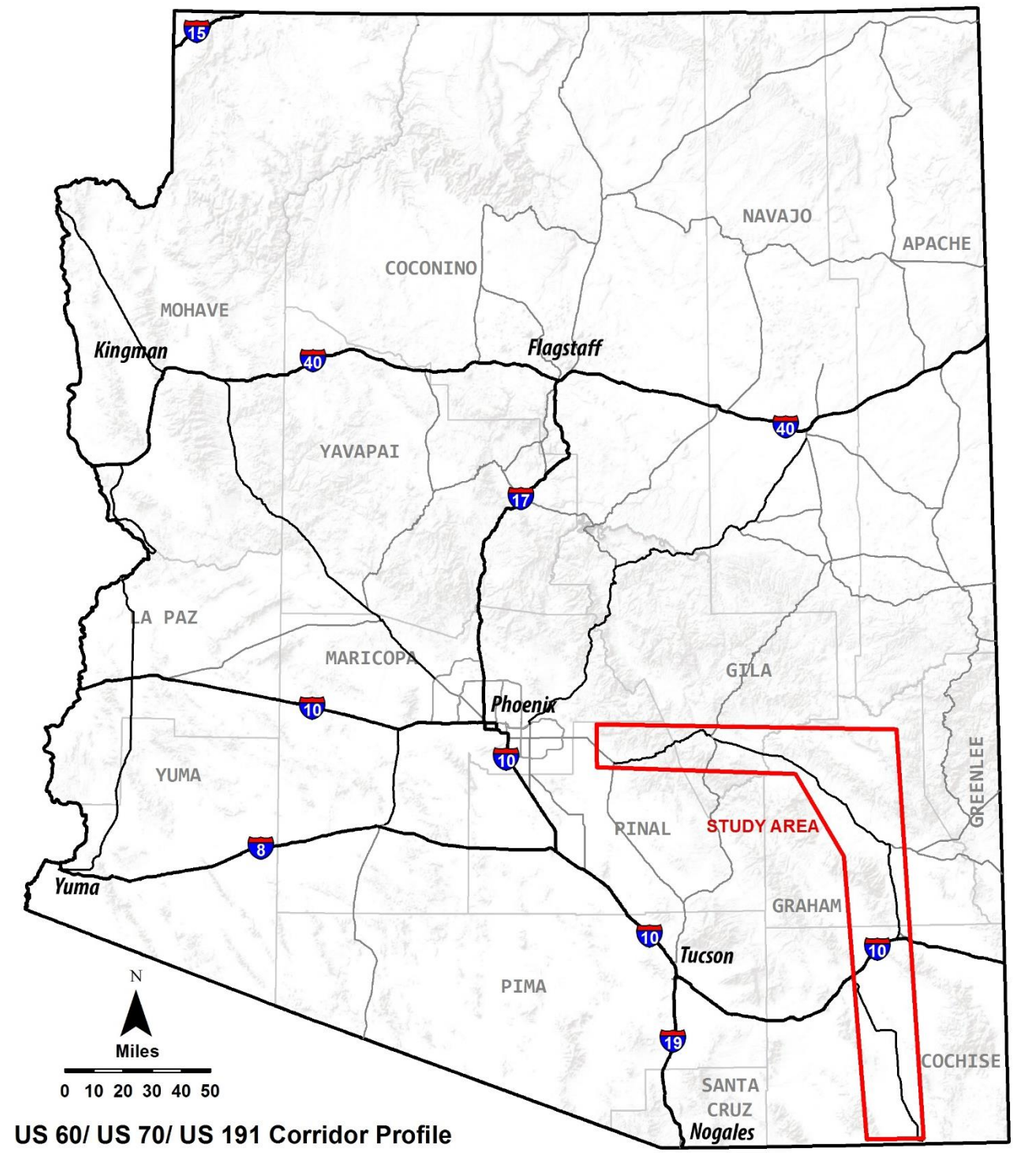
The third round (Round 3) of studies, initiated in fall 2015, includes:

- I-10: California State Line to SR 85 and SR 85: I-10 to I-8
- I-10: SR 202L to the New Mexico State Line
- SR 87/SR 260/SR 377: SR 202L to I-40
- US 60/US 70: SR 79 to US 191 and US 191: US 70 to SR 80
- US 93/US 60: Nevada State Line to SR 303L

The studies under this program will assess the overall health, or performance, of the state's strategic highways. The Corridor Profile Studies will identify candidate projects for consideration in the Multimodal Planning Division's (MPD) Planning to Programming (P2P) project prioritization process, providing information to guide corridor-specific project selection and programming decisions.

US 60|US 70: SR 79 to US 191 and US 191: US 70 to SR 80 (US 60|US 70|US 191), depicted in **Figure 1**, is one of the strategic statewide corridors identified and is the subject of this Round 3 Corridor Profile Study.

Figure 1: Study Area



1.1 Corridor Study Purpose

The purpose of the US 60|US 70|US 191 Corridor Profile Study is to define a comprehensive corridor planning and programming approach to help make system decisions to Arizona's transportation primary network. This is to be achieved by measuring corridor performance and using the findings to inform improvement solutions. Life-cycle cost analysis and risk assessment are to be applied in formulating corridor recommendations. This Corridor Profile Study, along with similar studies for the other ten strategic corridors, will:

- Inventory past improvement recommendations
- Assess the existing performance based on quantifiable performance measures
- Define measureable performance goals and objectives for the future of the corridor
- Propose various solutions to improve corridor performance
- Identify specific projects that can provide quantifiable benefits in relation to the performance measures
- Prioritize the projects for future implementation

1.2 Corridor Study Goals and Objectives

The objective of this study is to identify a recommended set of potential projects for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The US 60|US 70|US 191 Corridor Profile Study will define solutions and improvements within the study limits that can be evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing system performance.

The following goals have been identified as the outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Develop solutions that address identified corridor needs based on measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

1.3 Working Paper 4 Overview

The purpose of Working Paper 4 is to document the performance-based needs for the US 60|US 70|US 191 corridor within the study limits. Corridor needs are defined through a review of the difference in baseline corridor performance (Task 2) and the performance objectives (Task 3) for each of the five performance areas used to characterize the health of the US 60|US 70|US 191 corridor: pavement, bridge, mobility, safety, and freight. The product of Working Paper 4 is actionable performance needs that can be addressed through strategic investments in corridor preservation, modernization, and expansion.

1.4 Corridor Overview

The US 60|US 70|US 191 corridor links the Mexico border at the City of Douglas and the Phoenix metropolitan area to agricultural, mining and recreational activity in southeastern Arizona. In general, all three highways are two-lane facilities designed for relatively modest traffic volumes in a rural setting. At the same time, the corridor offers some unique benefits within the Arizona circulation system that could be leveraged for increased usage as the need arises.

US 191 provides a link between Mexico and Interstate 10 (I-10), the primary east-west interstate corridor along the southern states. As a result, US 191 serves as a major freight corridor for goods moving between Mexico and the United States. Similarly, the combination of US 191 and US 70 between I-10 and Globe offers a critical connection to mining and agricultural interests located in the greater Safford and Globe areas of Graham and Pinal Counties. US 60 between Globe and SR 79 links activities within the corridor to the major population and commerce center of the Phoenix metropolitan area.

The combination of all three highways (US 60|US 70|US 191) creates a potentially significant alternative to I-10 and I-19 for travel in the eastern reaches of Arizona. A seamless connection among the three routes as a reliever could have major implications for improving international, interstate and intrastate trade along with opening access to financial and commercial distribution centers in the Phoenix area. It would also provide enhanced accessibility to tourist and recreational opportunities in southeastern Arizona.

1.5 Study Location and Corridor Segments

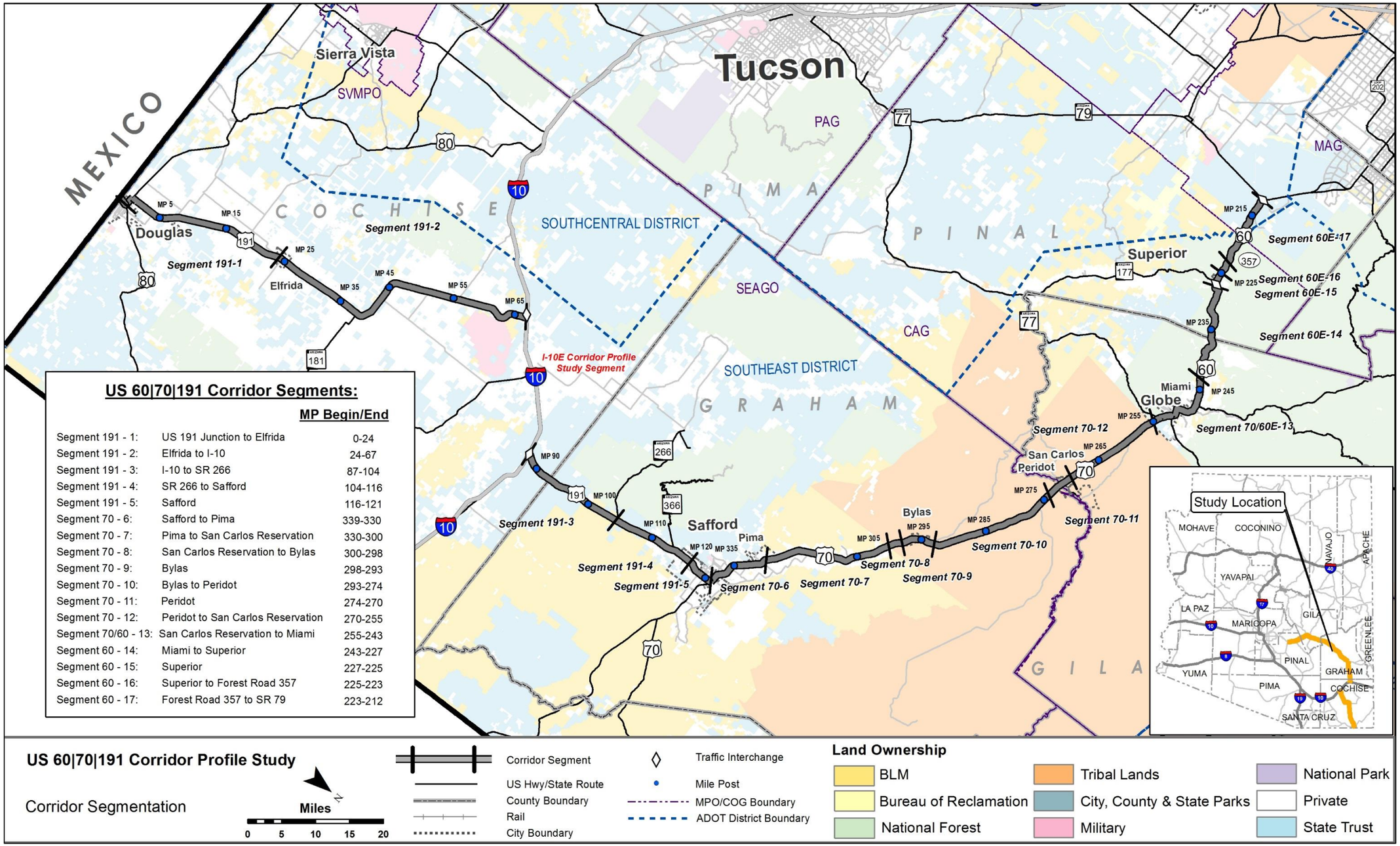
The US 60|US 70|US 191 Corridor Profile Study limits extend along US 191 from Douglas to I-10, continuing along US 191 from I-10 to Safford to the junction with US 70, then following US 70 from Safford, passing through the San Carlos Apache Reservation to Globe, and transitioning to the US 60 from Globe, through Superior to Florence Junction at the US 60|SR 79 intersection. Study segments were identified based on consideration of roadway, traffic and jurisdictional characteristics to allow for an appropriate level of analysis for segments of similar operating environments. Seventeen segments have been identified by the project team. **Table 1** (Page 3) and the Corridor Map (**Figure 2**, Page 5) describe these segments, including general characteristics such as location, and average daily traffic (ADT).

Table 1: US 60|US 70|US 191 Corridor Segmentation

Segment	Route	Begin	End	Approximate Begin Milepost	Approximate End Milepost	Approximate Length (miles)	Through Lanes (NB, SB)	2014 Average Annual Daily Traffic Volume (vpd)	Character Description
191B – 1A	US 191	U.S. Mexico Border	US 191 Junction	0.0	1.0	1	2,2	8,000 – 13,000	This segment begins at the Douglas Port of Entry and continues north along US 191B (Pan American Avenue) until the intersection with US 191 (16th Street). The high traffic counts can be attributed to the international border crossing as well as the mixed industrial/commercial/residential uses along the route. This segment will not be included in this study as the facility is currently being turned over from ADOT to Douglas.
191-1	US 191	US 191B Junction	Elfrida	0.0	24.0	24	1,1	1,000 – 2,000	Starting from MP 0 along US 191, this segment is primarily rural in nature, but is the only route to the Bisbee-Douglas International Airport.
191-2	US 191	Elfrida	I-10	24.0	67.0	43	1,1	1,000 – 2,000	Beginning in Elfrida, a census-designated place, this segment connects smaller agricultural communities to each other and I-10.
191-3	US 191	I-10	SR 266	87.0	104.0	17	2,2	2,000	No known developments exist along this segment however, it does connect the Arizona State Prison at Fort Grant to I-10 via SR 266.
191-4	US 191	SR 266	Safford City Limit	104.0	116.0	12	1,1	3,000 – 7,000	Land along this segment is primarily owned by the Bureau of Reclamation and is therefore undeveloped. The segment begins at SR 266 and ends at approximately the southern limits of Safford. Traffic numbers in this segment increase due to the development south of Safford.
191-5	US 191	Safford City Limit	US 70 Junction	116.0	121.0	5	2,2	8,000 – 9,000	This segment starts at approximately the southern limits of Safford and ends at the junction with US 70. The segment is differentiated by jurisdiction and change in route along the corridor rather than any changes in terrain or traffic.
70-6	US 70	US 191 Junction	Pima	339.0	330.0	9	2,2	5,000 – 23,000	Beginning at the junction with US 191 in Safford and ending at the northern limit of Pima, this segment has very high traffic volumes which can be attributed to the higher density of surrounding communities and agricultural/mining operations. A large majority of the land abutting the route is privately owned.
70-7	US 70	Pima	San Carlos Apache Reservation	330.0	300.0	19	1,1	3,000 – 5,000	This segment connects the western limit of Pima to the eastern edge of the San Carlos Apache Reservation. A majority of the land abutting US 70 is privately owned and used for agricultural purposes. Milepost equation MP 314.21 Back = MP 325.31 Ahead occurs within this segment.
70-8	US 70	San Carlos Apache Reservation	Bylas	300.0	298.0	2	1,1	3,000	Beginning at the eastern limits of the San Carlos Apache Reservation, this short segment terminates at the eastern limits of Bylas.
70-9	US 70	Bylas	Bylas	298.0	293.0	5	1,1	3,000	Bylas is a census-designated place within the San Carlos Apache Reservation. The boundary of this segment was determined by the extent of development and not necessarily the jurisdictional limits.
70-10	US 70	Bylas	Peridot	293.0	274.0	19	1,1	3,000	This segment begins at the western extent of development in Bylas and extends to the eastern limits of development in Peridot. The segment is within the San Carlos Reservation and has low traffic volume.

Segment	Route	Begin	End	Approximate Begin Milepost	Approximate End Milepost	Approximate Length (miles)	Through Lanes (NB, SB)	2014 Average Annual Daily Traffic Volume (vpd)	Character Description
70-11	US 70	Peridot	Peridot	274.00	270.00	4	1,1	3,000	The segment starts at the new medical center at the eastern limits of Peridot and extends west to the high school. It is differentiated by Graham/Gila County jurisdiction rather than changes in terrain or traffic.
70-12	US 70	Peridot	San Carlos Apache Reservation	270.00	255.00	15	1,1	4,000 – 7,000	Beginning at the Peridot High School and continuing to the western limit of the San Carlos Apache Reservation, this segment is differentiated by jurisdiction rather than any changes in terrain or traffic.
70|60-13	US 70 US 60	San Carlos Apache Reservation	Miami	255.00	243.00	12	2,2	3,000 – 28,000	Beginning at the western limits of the San Carlos Apache Reservation, this segment goes through the City of Globe, Claypool and Miami. Although this segment includes US 70 and US 60, there is no change in cross section therefore, the segment is differentiated by jurisdiction rather than any other changes. Higher traffic counts are due to the junction of US 60 and US 70 along with higher traffic counts and the proximity of large mines.
60-14	US 60	Miami	Superior	243.00	227.00	16	1,1	7,000 – 9,000	Beginning at the western limits of Miami and extending to the eastern limits of Superior, this segment bisects the Tonto National Forest. The high traffic volume can be attributed to a significant number of regular commuters in both directions (Valley to Globe) and tourist traffic.
60-15	US 60	Superior	Superior	227.00	225.00	2	1,1	10,000	This segment starts and ends at approximately the eastern and western limits of Superior. This segment is differentiated by jurisdiction rather than any changes in terrain or traffic.
60-16	US 60	Superior	Forest Road 357	225.00	223.00	2	1,1	9,000	This segment is bounded by the Tonto National Forest and is differentiated by the number of thru east and west lanes rather than changes in terrain or jurisdiction.
60-17	US 60	Forest Road 357	SR 79	223.00	212.00	11	2,2	10,000	Although this segment is generally flat in nature, it is differentiated by the number of thru lanes, compared to 60-16. Beginning at State Forest Road 357, this segment terminates at the interchange with SR 79.

Figure 2: Segmentation Map



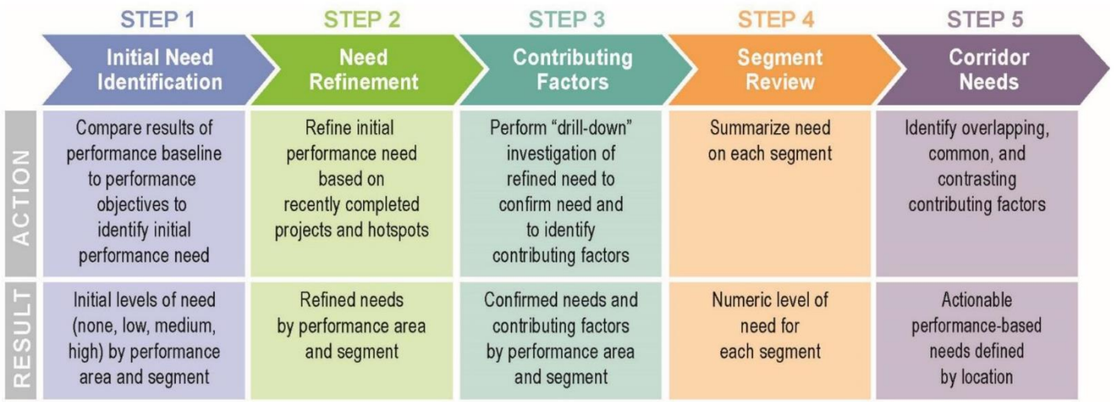
2.0 NEEDS ASSESSMENT PROCESS

A collaborative process involving ADOT Multimodal Planning Department (MPD) staff and the corridor profile study teams was used to develop a framework for the performance-based needs assessment process. The following guiding principles were developed as an initial step in process development:

- Corridor needs are defined as the difference between corridor performance and the performance objectives.
- The needs assessment process should be systematic, progressive, and repeatable, but also include engineering judgment.
- The process should consider all primary and secondary performance measures developed for the study.
- The process should develop multiple need levels including programmatic needs for the entire length of the corridor, performance area-specific needs, segment-specific needs, and location-specific needs (defined by milepost limits).
- The process should produce actionable needs that can be addressed through strategic investments in corridor preservation, modernization, and expansion.

The performance-based needs assessment process is illustrated in **Figure 3** and described in the following sections of the working paper.

Figure 3: Needs Assessment Process



2.1 Step 1: Initial Need Identification

The first step in the needs assessment process links baseline (existing) corridor performance documented in Working Paper 2 with performance objectives documented in Working Paper 3. In this step, the baseline corridor performance is compared to the performance objectives to provide a starting point for the identification of initial performance needs. This mathematical comparison results in an initial need rating of None, Low, Medium, or High for each primary and secondary performance measure. An illustrative example of this process for the bridge performance measure is shown in **Figure 4**.

Figure 4: Initial Need Ratings in Relation to Baseline Performance (Bridge Example)

Performance Thresholds	Performance Level	Initial Level of Need	Description
6.5	Good	None	All levels of Good and top 1/3 of Fair (>6.0)
	Good		
	Good		
	Fair		
	Fair	Low	Middle 1/3 of Fair (5.5-6.0)
5.0	Fair	Medium	Lower 1/3 of Fair and top 1/3 of Poor (4.5-5.5)
	Poor		
	Poor	High	Lower 2/3 of Poor (<4.5)
	Poor		

Initial levels of needs for each performance measure are combined to produce a weighted initial need rating for each segment. Values of 0, 1, 2, and 3 are assigned to the initial need levels of None, Low, Medium, and High, respectively. A weight of 1.0 is applied to the Performance Index need and equal weights of 0.20 are applied to each need for each secondary performance measure. For directional secondary performance measures, each direction of travel receives a weight of 0.10. The secondary performance measure needs are added to the need from the Primary Index to create a cumulative measure of need. The resulting weighted initial level of need is assigned a level of None, Low, Medium, or High. With this approach, the resulting segment level of need is always equal to or higher than the Primary Index need.

2.2 Step 2: Need Refinement

In Step 2, the initial level of need for each segment is refined using the following information and engineering judgment.

- If an initial need is not identified, the existence of hot spots in the segment is justification for increasing the level of need from None to Low
- Recently completed projects or projects under construction may be justification for lowering or eliminating a need
- Programmed projects should not be used to lower the initial need because the project may not be implemented as planned. In addition, further investigations may suggest that changes in the scope of a programmed project may be warranted

The resulting final need (potential increase, decrease, or no change from initial need) is carried forward for further evaluation in Step 3.

2.3 Step 3: Contributing Factors

In Step 3, a more detailed review of the condition and performance data available from ADOT is conducted to identify contributing factors to the need. Typically, the same databases that are used to develop the baseline performance serve as the principal sources for the more detailed analysis. The databases used for diagnostic analysis are listed below.

Pavement Performance Area

- Pavement Rating Database

Bridge Performance Area

- Bridge Information and Storage System

Mobility Performance Area

- Highway Performance Monitoring System (HPMS) Database
- Arizona Travel Demand Model (AZTDM)
- HERE Travel Time Database
- Highway Condition Reporting System (HCRS) Closure Database

Safety Performance Area

- Crash Database

Freight Performance Area

- HERE Database
- HCRS Database

In addition, other sources are considered to help identify the contributing factors, such as:

- Maintenance history (from ADOT PeCos for pavement), the level of past investments, or trends in historical data are used to help provide context for pavement and bridge history.
- Field observations from ADOT district personnel could be used to provide additional information regarding a need that has been identified
- Previous studies could be used to provide additional information regarding contributing factors to a need that has been identified

Step 3 results in the identification of contributing factors to needs by segment (and milepost locations, if appropriate) that can be addressed through investments in preservation, modernization, and expansion projects to improve corridor performance.

2.4 Step 4: Segment Review

In this step, the needs from Step 2 are quantified for each segment to numerically estimate the level of need for each segment. Values of 0, 1, 2, and 3 are assigned to the final need levels (from Step 2) of None, Low, Medium, and High, respectively. A weight factor of 1.5 is applied to the performance areas that are identified as Emphasis Areas in Working Paper 3 and a weighted average need is calculated for each segment. The resulting average need value can be used to compare needs across corridors and to determine the location of the highest needs.

2.5 Step 5: Corridor Needs

In this step, the needs and contributing factors for each performance area are reviewed on a segment-by-segment basis to identify actionable needs and to facilitate the formation of solutions that address multiple performance areas and contributing factors. The intent of this process is to identify overlapping, common, and contrasting needs to help develop strategic solutions. This step results in the identification of corridor needs by specific location.

3.0 PAVEMENT PERFORMANCE AREA NEEDS (STEPS 1-3)

The following sections describe Steps 1 through 3 of the Needs Assessment process for the US 60|US 70|US 191 corridor in the Pavement Performance Area. The methodology for performing Steps 1 through 3 is provided in **Appendix A**.

3.1 Step 1: Initial Pavement Needs

The baseline performance scores (from Working Paper 2) and performance objectives (from Working Paper 3) for the US 60|US 70|US 191 corridor were used to determine the initial pavement needs, as described in Section 2.1. The pavement condition data used to calculate baseline performance was provided by ADOT for the timeframe from 2014 through 2015.

Step 1 uses the scores for the Pavement Index primary performance measure and two secondary performance measures to determine the initial level of need by segment for each performance measure individually as well as for all performance measures combined. The two secondary performance measures are Directional PSR and Percent Pavement Failure.

The performance scores, performance objectives, and initial levels of need for each pavement performance measure and for all pavement performance measures combined are shown in **Table 2**.

For the Pavement Index, zero segments report a high level of need and one segment report a medium level of need. For the Directional PSR, zero segments report a high level of need and only one segment reported a medium level of need. For Percent Pavement Failure, three segments report a high level of need and three segments reports a medium level of need. For all pavement performance measures combined, one segment report a high level of initial need and three segments report a medium level of initial need.

3.2 Step 2: Final Pavement Needs

Once the initial pavement needs by segment for the US 60|US 70|US 191 corridor were established, they were then refined in Step 2 as described in Section 2.2 to more accurately reflect existing needs. An evaluation of pavement hot spots as well as relevant recently completed and under-construction projects was performed to determine if segment need levels required adjustment. The initial needs were then refined based on this assessment to determine the final need for each segment. Planned and programmed future projects and other issues identified in previous reports were noted for future reference in developing solutions that address identified needs. The Step 2 process is described in more detail below and summarized in **Table 3**.

Pavement Hot Spots

Ten segments contain pavement failure hot spots. The locations of pavement hot spots are listed in **Table 3**. Since four hot spots occur within segments that did not have an identified initial need, adjustments were made to the need level of these segments to account for hot spots.

Recently Completed and Under-Construction Projects

ADOT provided information on potentially relevant recently completed and under-construction projects that were not previously reflected in the baseline performance data. This includes any projects completed or under construction after 2014 that have the potential to mitigate a pavement need on a corridor segment.

Seven segments contain recently completed or under-construction projects which would supersede the pavement condition data, as shown in **Table 3**. This information was used to eliminate the need on two segments and reduce the level of need on one segment. The need level of the other segments remained the same since the projects did not address the locations with poor performance.

Planned or Programmed Projects

Information was noted in **Table 3** on pavement-related planned and programmed projects and other issues identified in previous reports in Working Paper 1. Planned and programmed projects and identified issues do not influence the level of need, but were documented for future reference in developing solutions that address identified needs.

3.3 Step 3: Pavement Contributing Factors

The final needs for the US 60|US 70|US 191 corridor were further investigated as described in Section 2.3. ADOT provided pavement rehabilitation project data for the last 20 years which was used to estimate the level of historical investment in each segment and is summarized in **Figure 5**.

In addition, PeCOS data was collected for each segment to estimate the level of pavement maintenance activity. If the PeCOS data showed a high level of maintenance investment, the overall historical investment was elevated by one need level (from “Medium” to “High”, for example). There are two segments with a high level of overall historical investment. Additional information regarding the determination of the level of historical investment is contained in **Appendix A**.

Considering the information reviewed in Step 2 and the level of historical investment, the contributing factors noted in Step 3 identify the specific locations of needs not presently addressed and any additional supporting information available from the ADOT Districts. A summary of this process is shown in **Table 4**.

Table 2: Initial Pavement Needs (Step 1)

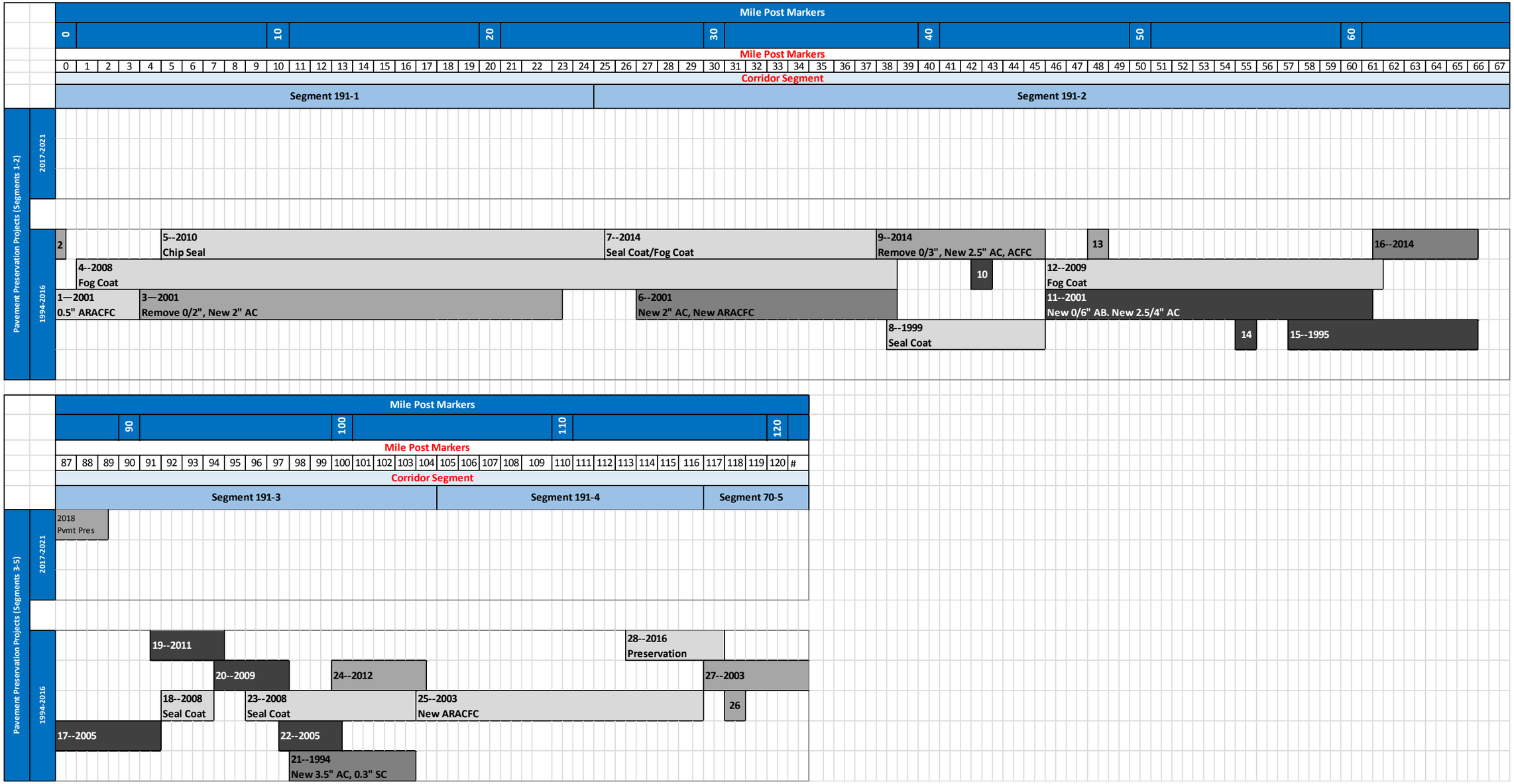
Segment	Segment Length (miles)	Segment Mileposts (MP)	Facility Type	Pavement Index			Directional PSR					% Pavement Failure			Initial Need
				Performance Score	Performance Objective	Level of Need	Performance Score		Performance Objective	Level of Need		Performance Score	Performance Objective	Level of Need	
							NB/WB	SB/EB		NB/WB	SB/EB				
191-1	24	0-24	Highway	3.64	Fair or Better	None	3.37	3.37	Fair or Better	None	None	0.00%	Fair or Better	None	None
191-2	43	24-67	Highway	3.06	Fair or Better	Medium	3.31	3.31	Fair or Better	None	None	30.23%	Fair or Better	High	High
191-3	17	87-104	Highway	3.93	Fair or Better	None	3.94	4.02	Fair or Better	None	None	2.94%	Fair or Better	None	None
191-4	12	104-116	Highway	3.28	Fair or Better	Low	3.28	3.28	Fair or Better	Low	Low	16.67%	Fair or Better	Medium	Medium
191-5	5	116-121	Highway	3.28	Fair or Better	Low	3.28	3.28	Fair or Better	Low	Low	20.00%	Fair or Better	Medium	Medium
70-6	9	339-330	Highway	3.70	Fair or Better	None	3.44	3.44	Fair or Better	None	None	10.00%	Fair or Better	None	None
70-7	19	330-300	Highway	3.43	Fair or Better	None	3.35	3.35	Fair or Better	None	None	5.26%	Fair or Better	None	None
70-8	2	300-298	Highway	3.87	Fair or Better	None	3.78	3.78	Fair or Better	None	None	0.00%	Fair or Better	None	None
70-9	5	298-293	Highway	3.81	Fair or Better	None	3.80	3.80	Fair or Better	None	None	0.00%	Fair or Better	None	None
70-10	19	293-274	Highway	3.87	Fair or Better	None	3.55	3.55	Fair or Better	None	None	5.26%	Fair or Better	None	None
70-11	4	274-270	Highway	3.88	Fair or Better	None	3.55	3.55	Fair or Better	None	None	0.00%	Fair or Better	None	None
70-12	15	270-255	Highway	3.97	Fair or Better	None	3.83	3.83	Fair or Better	None	None	0.00%	Fair or Better	None	None
70/60E-13	12	255-243	Highway	3.65	Fair or Better	None	3.43	3.34	Fair or Better	None	None	18.52%	Fair or Better	Medium	Low
60E-14	16	243-227	Highway	3.43	Fair or Better	None	3.24	3.24	Fair or Better	Low	Low	31.25%	Fair or Better	High	Low
60E-15	2	227-225	Highway	3.21	Fair or Better	Low	2.92	2.92	Fair or Better	Medium	Medium	50.00%	Fair or Better	High	Medium
60E-16	2	225-223	Highway	3.32	Fair or Better	None	3.38	3.38	Fair or Better	None	None	0.00%	Fair or Better	None	None
60E-17	11	223-212	Highway	4.30	Fair or Better	None	4.14	4.02	Fair or Better	None	None	0.00%	Fair or Better	None	None
Pavement Emphasis Area?	**No**	**Corridor Weighted Average**		**3.57**	**Fair or Better**	**None**									

Table 3: Final Pavement Needs (Step 2)

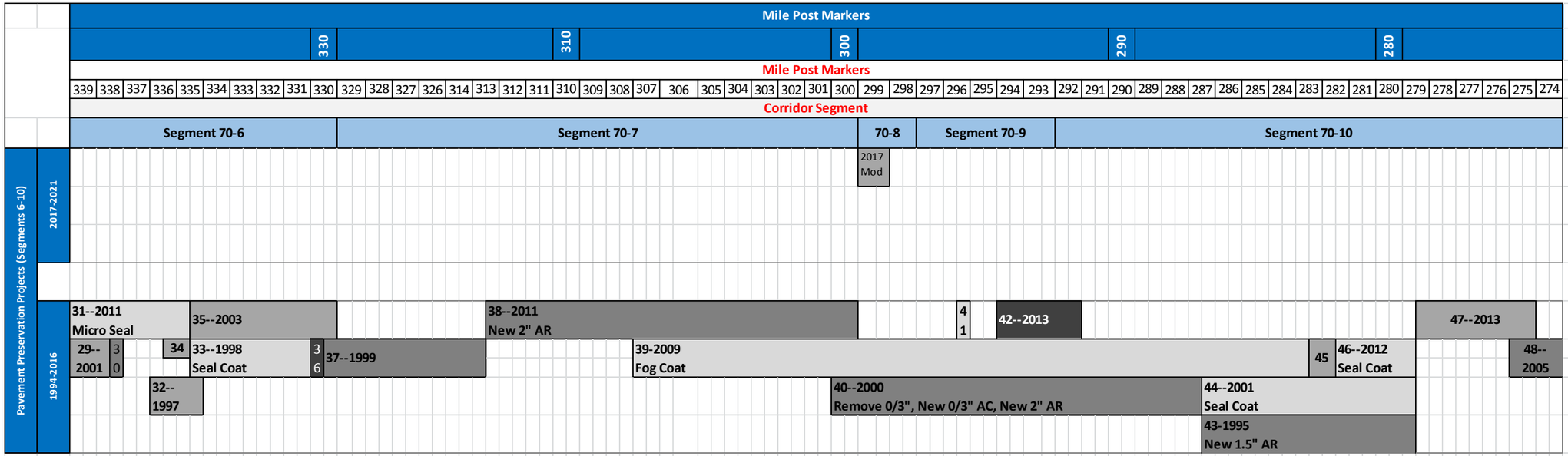
Segment	Segment Length (miles)	Segment Mileposts (MP)	Initial Need	Need Adjustments		Final Need	Comments (may include programmed projects or issues from previous reports)
				Hot Spots	Previous Projects (which supersede condition data)		
191-1	24	0-24	None	-	-	None	The segment had an initial need of none and no hot spots were identified. There are no programmed or planned projects in this segment.
191-2	43	24-67	High	NB MP 24-27, NB MP 38-41, NB MP 45-46, NB MP 48-51, NB MP 62-64, NB MP 66-67	**MP 25.54-37.97 (H8652):** Double chip seal coat and replace pavement markings **MP 37.97-45.80 (H8124):** Mill existing pavement and replace with AC and new AR-ACFC **MP 61.50-66.60 (H7883):** Pavement rehabilitation including milling, replacement and AC overlay, applications of chip seal and paving turnouts	Low	The initial low rating for this segment was due to the high percent of pavement failure and numerous hot spots. A majority of the hotspots locations were addressed with the identified pavement projects however, the hot spot located at MP 48-51 was not. No further planned or programmed projects were identified.
191-3	17	87-104	None	SB MP 87-88	**MP 100.59-104.00 (H8185):** Overlay the existing pavement with AC and AR-ACFC	Low	The segment had an initial need of none. One hot spot was identified but not addressed in the pavement preservation project which superseded the condition data. One future pavement preservation project was identified between MP 86.89 - 90.11, ADOT Five Year Program (H7866-FY18).
191-4	12	104-116	Medium	NB MP 105-107	**MP 104.00-104.52 (H8185):** Overlay the existing pavement with AC and AR-ACFC	Medium	The segment had an initial need of medium. One hot spot was identified but not addressed in the pavement preservation project which superseded the condition data. One programmed projects exists in this segment, MP 114-116, ADOT Five Year Program FY16 (H8700).
191-5	5	116-121	Medium	NB MP 120-121	-	Medium	The segment had an initial need of medium and one hot spot was identified. One programmed projects exists in this segment, MP 116-118, ADOT Five Year Program FY16 (H8700).
70-6	9	339-330	None	WB MP 336-337	-	Low	The segment had an initial need of none and one hot spot was identified. One programmed project exists in this segment for misc safety work, MP 338-339, ADOT Five Year Program (FY18).
70-7	19	330-300	None	WB MP 300-301	-	Low	The segment had an initial need of none although one hot spot was identified. One programmed project was identified at MP 329 for ped bridge (H8397-FY17). The final need is Low due to the identified hot spot.
70-8	2	300-298	None	-	-	None	The segment had an initial need of none and no hot spots were identified. One programmed project was identified at MP 299 for bridge replacement (H8547-FY17).
70-9	5	298-293	None	-	-	None	The segment had an initial need of none and no hot spots were identified. There are no programmed or planned projects in this segment.
70-10	19	293-274	None	WB MP 283-284	**MP 275.0-279.5 (H8185):** Milling and replace with AC and new AR-ACFC plus Fog Coat of shoulders **MP 291.81- 293.74 (H6910):** Remove the existing 23-span steel girder bridge and replace it with a 15-span precast prestressed concrete AASHTO Type VI girder bridge. The project includes roadway approach widening.	Low	The segment had an initial need of none although one hot spot was identified. One programmed project was identified at MP 291 for pathway (H7637-FY17).The final need is low due to the identified hot spot.

Segment	Segment Length (miles)	Segment Mileposts (MP)	Initial Need	Need Adjustments		Final Need	Comments (may include programmed projects or issues from previous reports)
				Hot Spots	Previous Projects (which supersede condition data)		
70-11	4	274-270	None	-	-	None	The segment had an initial need of none and no hot spots were identified. There are no programmed or planned projects in this segment.
70-12	15	270-255	None	-	-	None	The segment had an initial need of none and no hot spots were identified. One programmed project was identified from MP 269 - 271 for passing lane (FY18).
70/60E-13	12	255-243	Low	EB MP 247-248, EB MP 249-251	-	Low	The segment had an initial need of low and a number of hot spots were identified.
60E-14	16	243-227	Low	WB MP 229-233, WB MP 235-236	**MP 229.48-241.93 (H5818):** Construct climbing and passing lanes	Low	The segment had an initial need of low and a number of hot spots were identified. Construction of passing lanes (H5818) will address some of the current pavement needs. One additional programmed project is identified for MP 238 for bridge replacement (H8243-FY18).
60E-15	2	227-225	Medium	WB MP 226-227	**MP 225-226.87 (H7900):** Reconstruct existing 2-lane undivided roadway into a 4-lane divided highway and reconstruct the existing 3-lane roadway into a 4-lane roadway with a raised median	None	The segment had an initial need of medium and one hot spot was identified. The reconstruction project currently under construction (H7900) will address the pavement issues associated with the initial need.
60E-16	2	225-223	None	-	**MP 223-225 (H7900):** Reconstruct existing 2-lane undivided roadway into a 4-lane divided highway and reconstruct the existing 3-lane roadway into a 4-lane roadway with a raised median	None	The segment had an initial need of none and no hot spots were identified.
60E-17	11	223-212	None	-	**MP 221.72-223 (H7900):** Reconstruct existing 2-lane undivided roadway into a 4-lane divided highway and reconstruct the existing 3-lane roadway into a 4-lane roadway with a raised median	None	The segment had an initial need of none and no hot spots were identified.

Figure 5: Pavement History



NOTE: See Page 14 for Pavement Treatment Reference Numbers and Legend



NOTE: See Page 14 for Pavement Treatment Reference Numbers and Legend

Pavement Treatment Reference Numbers			Legend
1. 2001 (NB/SB) Hxxxx: New 0.5" ARACFC	**26. 1999 (NB/SB)** Hxxxx: Remove 0.6", New ARACFC	**51. 1998 (EB/WB)** Hxxxx: New 2" AR, New ARACFC	New Paving or Reconstruction
2. 2007 (NB/SB) Hxxxx: Remove 0.5", New 0.5" ARACFC	**27. 2003 (NB/SB)** Hxxxx: Remove 2", New 2" AR, New ARACFC	**52. 1997 (EB)** Hxxxx: Remove 0.6", New ACFC	Mill and Overlay (Adding Structural Thickness)
3. 2001 (NB/SB) Hxxxx: Remove 0/2", New 2" AC	**28. 2016 (NB/SB)** H8700: Pavement Preservation	**53. 2004 (EB/WB)** Hxxxx: Remove 3", New 3" AC, New ARACFC	Mill and Replace (No Change Structural Thickness)
4. 2008 (NB/SB) Hxxxx: Fog Coat	**29. 2001 (EB/WB)** Hxxxx: Remove 0.7", New 0.7" AC, New ARACFC	**54. 2004 (EB/WB)** Hxxxx: Remove 3", New 3" AC, New ARACFC	Fog Coat or Thin Overlay Treatments
5. 2010 (NB/SB) Hxxxx: Chip Seal	**30. 2009 (EB/WB)** Hxxxx: New 0/1" AC, New ARACFC	**55. 2012 (EB/WB)** Hxxxx: Micro Seal	PCCP Pavement Border
6. 2001 (NB/SB) Hxxxx: New 2" AC, New ARACFC	**31. 2011 (EB/WB)** Hxxxx: Micro Seal	**56. 1998 (EB/WB)** Hxxxx: Remove 0.63", New ARACFC	AC Pavement Border
7. 2014 (NB/SB) Hxxxx: Seal Coat/Fog Coat	**32. 1997 (EB/WB)** Hxxxx: Remove 3", New 3" AC, 0.3" SC	**57. 2003 (EB/WB)** Hxxxx: Remove 2/3", New 2/3" AR	
8. 1999 (NB/SB) Hxxxx: Seal Coat	**33. 1998 (EB/WB)** Hxxxx: Seal Coat	**58. 1999 (EB/WB)** Hxxxx: New ACFC	
9. 2014 (NB/SB) Hxxxx: Remove 0/3", New 2.5" AC, New ACFC	**34. 2009 (EB)** Hxxxx: Remove 2/3", New 2/3" AC	**59. 2010 (EB/WB)** Hxxxx: Remove 3/6", New 3/6" AC	
10. 2006 (NB/SB) Hxxxx: New 8" AB, New 4" AC, 0.3" SC	**35. 2003 (EB/WB)** Hxxxx: Remove 0/3", New 3" AC, New ARACFC	**60. 2003 (EB/WB)** Hxxxx: Remove 4", New 4" AC, New ARACFC	
11. 2001 (NB/SB) Hxxxx: New 0/6" AB. New 2.5/4" AC	**36. 1998 (EB/WB)** Hxxxx: New 6" AB, New 4" AC	**61. 2010 (EB/WB)** Hxxxx: Remove 0/3.5", New 0/6" AB, New 3/6" AC, New ARACFC	
12. 2012 (NB/SB) Hxxxx: Fog Coat	**37. 1999 (EB/WB)** Hxxxx: Remove 1", New 0/2" AC, New 0/2" AR	**62. 2000 (EB/WB)** Hxxxx: Remove 4/5", New 4/5" AC, New ARACFC	
13. 2009 (NB/SB) Hxxxx: Remove 0.5", New ACFC	**38. 2001 (EB/WB)** Hxxxx: New 2" AR	**63. 2009 (EB/WB)** Hxxxx: Fog Coat	
14. 2005 (NB/SB) Hxxxx: New 0/8" AB, New4.5/ AC, 0.3" SC	**39. 2009 (EB/WB)** Hxxxx: Fog Coat	**64. 2011 (EB/WB)** Hxxxx: Chip Seal	
15. 1995 (NB/SB) Hxxxx: New 0/12" AB, New 2/4" AC, New 2" RO, 4" MC, 0.3" SC, New ARACFC	**40. 2000 (EB/WB)** Hxxxx: Remove 0/3", New 0/3" AC, New 2" AR	**65. 2009 (EB/WB)** Hxxxx: Grind	
16. 2014 (NB/SB) Hxxxx: Remove 2.5/4", New 4.5/7.5" AC, 0.5 DC", New ACFC	**41. 2004 (EB/WB)** Hxxxx: Fogcoat	**66. 1996 (EB/WB)** Hxxxx: New 0/6" AB, Remove 0/2.5", New 0/4" AC, New ARACFC	
17. 2005 (NB/SB) Hxxxx: New 8' AB, New 2.5/5" AC, New ACFC	**42. 2013 (EB/WB)** Hxxxx: New 5" AB, New 5" AC, New ACFC	**67. 2000 (EB/WB)** Hxxxx: Remove 2", New 2" AC, New ACFC	
18. 2008 (NB/SB) Hxxxx: Seal Coat	**43. 1995 (EB/WB)** Hxxxx: New 1.5" AR	**68. 2003 (EB/WB)** Hxxxx: New 0/6" AB, New 0/6.5" AC, New 0/10" PC, New ARACFC	
19. 2011 (NB/SB) Hxxxx: New 0/8" AB, Remove 0/0.5", New ARACFC	**44. 2001 (EB/WB)** Hxxxx: Seal Coat	**69. 2001 (EB/WB)** Hxxxx: Seal Coat	
20. 2009 (NB/SB) Hxxxx: New 0/4" AB, Remove 0/1", New 3/5" AC, New ARACFC	**45. 2007 (EB/WB)** Hxxxx: Remove 2.5/31.5, New 0/5" AB, New 2.5/5" AC, New 0/18" BO, New ACFC	**70. 1996 (EB/WB)** Hxxxx: Remove 4", New 4" AC, New ARACFC	
21. 1994 (NB/SB) Hxxxx: New 3.5" AC, 0.3" SC	**46. 2012 (EB/WB)** Hxxxx: Seal Coat	**71. 2008 (EB/WB)** Hxxxx: Remove 0/2", New 5/9" AC, New ARACFC	
22. 2005 (NB/SB) Hxxxx: New 0/8" AB, New 0/5" AC, New ARACFC	**47. 2013 (EB/WB)** Hxxxx: Removed 3", New 3" AC, New ARACFC	**72. 2003 (EB/WB)** Hxxxx: New 6" AB, New 7" AC, New ARACFC	
23. 2008 (NB/SB) Hxxxx: Seal Coat	**48. 2005 (EB/WB)** Hxxxx: Remove 0/1.5", New 0/2.5" AR, New ARACFC	**73. 2014 (EB/WB)** H5818: Climbing/Passing Lane	
24. 2012 (NB/SB) Hxxxx: New 2.5" AC, New ARACFC	**49. 2013 (EB/WB)** Hxxxx: Removed 0.5", New 0.5" ACFC	**74. 2014 (EB/WB)** H7900: Reconstruction	
25. 2003 (NB/SB) Hxxxx: New ARACFC	**50. 2000 (EB/WB)** Hxxxx: Remove 0/4", New 2/4" AC, New ARACFC	**75. 2008 (EB/WB)** H7900: Reconstruction	

Table 4: Pavement Needs Contributing Factors (Step 3)

Segment	Segment Length (miles)	Segment Mileposts (MP)	Final Need	Bid History Investment	PeCos History Investment	Resulting Historical Investment	Contributing Factors and Comments
191-1	24	0-24	None	Low	Low	Low	
191-2	43	24-67	Low	Medium	Medium	Medium	Hot Spot at NB MP 48-51
191-3	17	87-104	Low	Medium	Low	Medium	
191-4	12	104-116	Medium	Low	High	Medium	Hot Spot at NB MP 105-107
191-5	5	116-121	Medium	Low	High	Medium	Hot Spot at NB MP 120-121
70-6	9	339-330	Low	Medium	Low	Medium	Hot Spot at WB MP 336-337
70-7	19	330-300	Low	Medium	Low	Medium	Hot Spot at WB MP 300-301
70-8	2	300-298	None	Medium	Low	Medium	
70-9	5	298-293	None	High	Low	High	
70-10	19	293-274	Low	Medium	High	High	Hot Spot at WB MP 283-284
70-11	4	274-270	None	Medium	Low	Medium	
70-12	15	270-255	None	Low	High	Medium	
70/60E-13	12	255-243	Low	Low	High	Medium	Hot Spot at EB MP 247-248, EB MP 249-251
60E-14	16	243-227	Low	Medium	Low	Medium	Hot Spot at WB MP 229-233, WB MP 235-236
60E-15	2	227-225	None	Medium	Low	Medium	
60E-16	2	225-223	None	Medium	Low	Medium	
60E-17	11	223-212	None	Medium	Medium	Medium	

4.0 BRIDGE PERFORMANCE AREA NEEDS (STEPS 1-3)

The following sections describe Steps 1 through 3 of the Needs Assessment process for the US 60|US 70|US 191 corridor for the Bridge Performance Area. The methodology for performing Steps 1 through 3 is provided in **Appendix A**.

4.1 Step 1: Initial Bridge Needs

The baseline performance scores (from Working Paper 2) and performance objectives (from Working Paper 3) for the US 60|US 70|US 191 corridor were used to determine the initial bridge needs, as described in Section 2.1. The bridge condition data used to calculate baseline performance was provided by ADOT for the timeframe from 2014 to 2015.

Step 1 uses the scores for the Bridge Index primary performance measure and three secondary performance measures to determine the initial level of need by segment for each performance measure individually as well as for all performance measures combines. The three secondary performance measures are Bridge Rating, Bridge Sufficiency, and Percent Functionally Obsolete Bridges).

The performance scores, performance objectives, and initial levels of need for each bridge performance measure and for all bridge performance measures combined are shown in **Table 5**.

For the Bridge Index, zero segments report a high level of need and four segments report a medium level of need. For the Bridge Index, zero segments report a high level of need and only two segments report a medium level of need. Only one segment reports a high level of need for Bridge Sufficiency and no segments report a medium level of need. For the Percent Functionally Obsolete Bridges, two segments report a high level of need. For all bridge performance measures combined, two segments report a high level of initial need and two segments report a medium level of initial need. Two segments do not include any structures, Segment 191-5 and Segment 70-9.

4.2 Step 2: Final Bridge Needs

Once the initial bridge needs by segment for the US 60|US 70|US 191 corridor were established, they were then refined in Step 2 as described in Section 2.2 to more accurately reflect existing needs. An evaluation of bridge hot spots as well as relevant recently completed and under-construction projects was performed to determine if segment need levels required adjustment. The initial needs were then refined based on this assessment to determine the final need for each segment. Planned and programmed future projects and other issues identified in previous reports were noted for future reference in developing solutions that address identified needs. The Step 2 process is described in more detail below and summarized in **Table 6**.

Bridge Hot Spots

There are three segments containing bridge hot spots, which are bridges with a single rating of 4 or less, or multiple ratings of 5 between the deck, superstructure, and substructure. The locations of bridge hot spots are listed in **Table 6**. All hot spots are within segments that already have an identified initial need, so no adjustments were made to the need level of any segments to account for hot spots.

Recently Completed and Under-Construction Projects

ADOT provided information on potentially relevant recently completed and under-construction projects that were not previously reflected in the baseline performance data. This includes any projects completed or under construction after 2014 that have the potential to mitigate a bridge need on a corridor segment.

There are eight segments containing recently completed or under-construction projects, as shown in **Table 3**. Only one segment warranted adjustments to the need level to account for recently completed or under-construction projects.

Planned or Programmed Projects

Information was noted in **Table 6** on bridge-related planned and programmed projects and other issues identified in previous reports in Working Paper 1. Planned and programmed projects and identified issues do not influence the level of need, but were documented for future reference in developing solutions that address identified needs.

4.3 Step 3: Bridge Contributing Factors

The final needs for US 60|US 70|US 191 corridor were further investigated as described in Section 2.3. ADOT provided historical bridge rating data for the last 17 years which was used to investigate historical trends for each bridge and is summarized in **Figure 6**.

Three segments contain five bridges identified as having possible historical concerns. The locations of the bridges with possible historical concerns are listed in **Table 6**. There are two segments containing bridges identified as being functionally obsolete. The number of functionally obsolete bridges is also shown in **Table 6**. While historical concerns and functional obsolescence were not used to adjust the level of need, they were listed in **Table 6** as input to the identification of contributing factors.

The current bridge ratings were reviewed to determine which rating (or ratings) were less than 6 (deck, superstructure, substructure, or structural evaluation rating). **Table 7** provides a summary of this information, identifies the bridges with potential historical concerns, and provides any additional information related to the contributing factors.

Table 5: Initial Bridge Needs (Step 1)

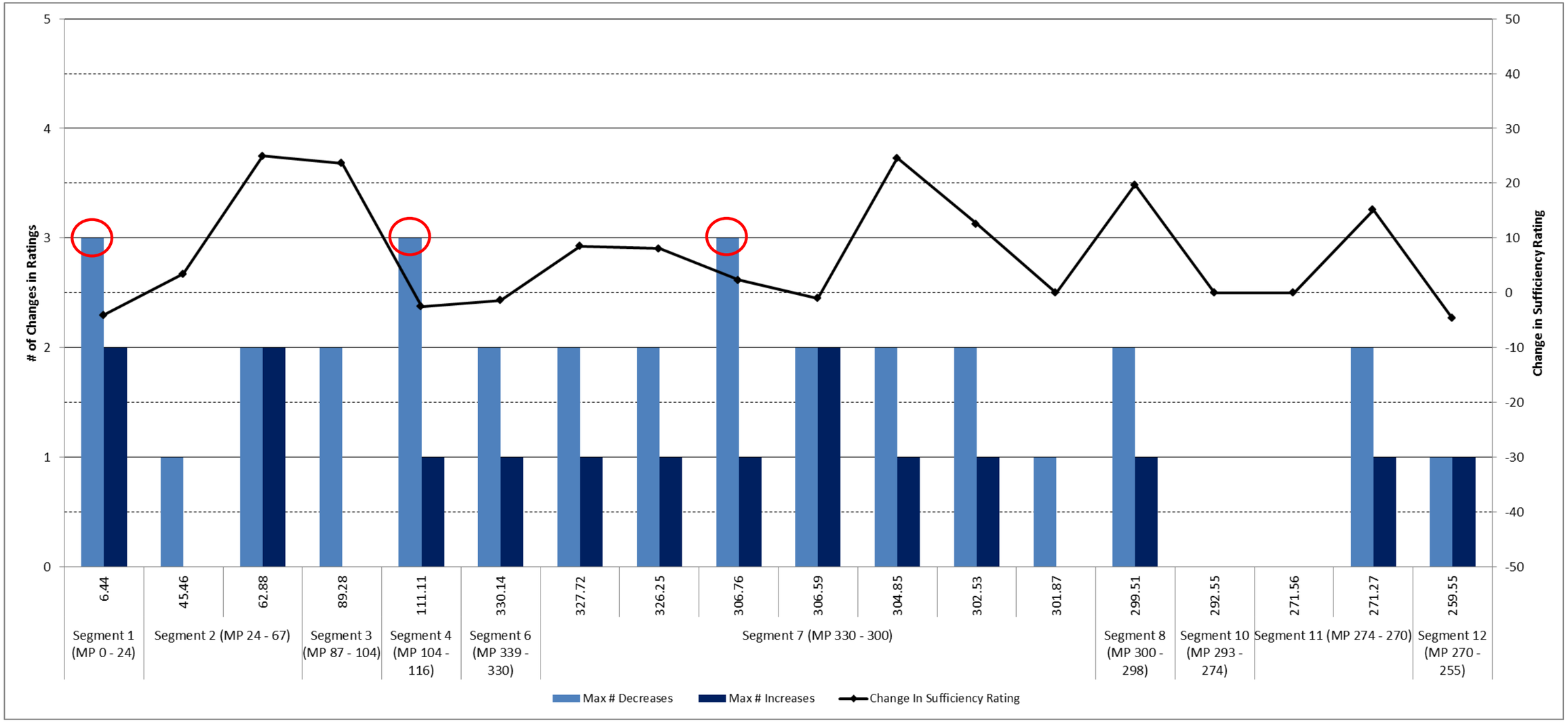
Segment	Segment Length (miles)	Segment Mileposts (MP)	Number of Bridges in Segment	Bridge Index			Bridge Rating			Bridge Sufficiency			% Functionally Obsolete Bridges			Initial Need
				Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	
191-1	24	0-24	1	6.00	Fair or Better	None	6	Fair or Better	None	89.0	Fair or Better	None	0.0%	Fair or Better	None	None
191-2	43	24-67	2	5.37	Fair or Better	Medium	5	Fair or Better	Low	76.9	Fair or Better	None	0.0%	Fair or Better	None	Medium
191-3	17	87-104	2	6.02	Fair or Better	None	5	Fair or Better	Low	93.9	Fair or Better	None	0.0%	Fair or Better	None	Low
191-4	12	104-116	1	6.00	Fair or Better	None	6	Fair or Better	None	69.5	Fair or Better	Low	0.0%	Fair or Better	None	Low
191-5	5	116-121	0	No Bridges within Segment												None
70-6	9	339-330	1	6.00	Fair or Better	None	6	Fair or Better	None	69.1	Fair or Better	Low	0.0%	Fair or Better	None	Low
70-7	19	330-300	8	5.77	Fair or Better	Low	5	Fair or Better	Low	71.6	Fair or Better	None	0.0%	Fair or Better	None	Low
70-8	2	300-298	1	6.00	Fair or Better	None	6	Fair or Better	None	74.0	Fair or Better	None	0.0%	Fair or Better	None	None
70-9	5	298-293	0	No Bridges within Segment												None
70-10	19	293-274	1	7.00	Fair or Better	None	7	Fair or Better	None	80.0	Fair or Better	None	0.0%	Fair or Better	None	None
70-11	4	274-270	2	7.54	Fair or Better	None	5	Fair or Better	Low	82.0	Fair or Better	None	0.0%	Fair or Better	None	Low
70-12	15	270-255	1	6.00	Fair or Better	None	6	Fair or Better	None	63.2	Fair or Better	Low	0.0%	Fair or Better	None	Low
70/60E-13	12	255-243	11	5.17	Fair or Better	Medium	4	Fair or Better	Medium	78.9	Fair or Better	None	49.4%	Fair or Better	High	High
60E-14	16	243-227	5	4.56	Fair or Better	Medium	4	Fair or Better	Medium	36.0	Fair or Better	High	0.0%	Fair or Better	None	High
60E-15	2	227-225	3	6.00	Fair or Better	None	6	Fair or Better	None	83.7	Fair or Better	None	57.5%	Fair or Better	High	Low
60E-16	2	225-223	2	5.00	Fair or Better	Medium	5	Fair or Better	Low	86.7	Fair or Better	None	0.0%	Fair or Better	None	Medium
60E-17	11	223-212	7	6.42	Fair or Better	None	5	Fair or Better	Low	91.1	Fair or Better	None	0.0%	Fair or Better	None	Low
Bridge Emphasis Area?	**No**	**Corridor Weighted Average**		**5.82**	**Fair or Better**	**Low**										

Table 6: Final Bridge Needs (Step 2)

Segment	Segment Length (miles)	Segment Mileposts (MP)	Number of Bridges in Segment	Initial Need	Need Adjustments		Final Need	Historical Review	# Functionally Obsolete Bridges	Comments
					Hot Spots (Rating of 4 or multiple 5's)	Previous Projects (which supersede condition data)				
191-1	24	0-24	1	None	-	-	None	Moffet Wash Bridge MP 6.44 (#297)	0	**Hot Spots:** None **Historical Review:** Moffet Wash Bridge MP 6.44 (#297) **Structures with Index rating with a 5:** None
191-2	43	24-67	2	Medium	-	**MP 37.97-45.80 (H8124):** Bridge deck repairs **MP 61.50-66.60 (H7883):** Bridge railing replacement	Medium		0	**Hot Spots:** None **Historical Review:** None **Structures with Index rating with a 5:** Cochise UPRR OP MP 62.88 (#157) No change in Final Needs is warranted as recent projects do not address segment needs
191-3	17	87-104	2	Low	-	-	Low		0	**Hot Spots:** None **Historical Review:** None **Structures with Index rating with a 5:** Monk Draw Bridge SB MP 89.28 (#292)
191-4	12	104-116	1	Low	-	-	Low	Stockton Wash Bridge MP 111.11 (#201)	0	**Hot Spots:** None **Historical Review:** Stockton Wash Bridge MP 111.11 (#201) **Structures with Index rating with a 5:** None
191-5	5	116-121	0	None	-	-	None	-	0	**Hot Spots:** None **Historical Review:** None **Structures with Index rating with a 5:** None
70-6	9	339-330	1	Low	-	-	Low	-	0	**Hot Spots:** None **Historical Review:** None **Structures with Index rating with a 5:** None
70-7	19	330-300	8	Low	Holyoak Wash Bridge MP 302.53 (#514)	**MP 326.25 (H8547):** Matthewsville Wash Bridge #394 scour repair project **MP 304.85 (H8547):** Fine Wash Bridge #515 scour repair project **MP 302.53 (H8547):** Holyoak Wash Bridge #514 scour repair project	Low	Black Rock Wash Bridge MP 306.76 (#545)	0	**Hot Spots:** Holyoak Wash Bridge MP 302.53 (#514) **Historical Review:** Black Rock Was Bridge MP 306.76 (#545) **Structures with Index rating with a 5:** Holyoak Wash Bridge MP 302.53 (#514); Black Rock Wash Bridge MP 306.76 (#545); Hunzinger Wash Bridge MP 313.62 (#561) **Programmed Projects:** Holyoak Wash Bridge (#514) and Matthewsville Wash Bridge (#394) (FY 17) No change in Final Needs is warranted as recent projects do not address segment needs
70-8	2	300-298	1	None	-	**MP 299.51 (H8547):** Bridge #513 scour repair project	None	-	0	**Hot Spots:** None **Historical Review:** None **Structures with Index rating with a 5:** None
70-9	5	298-293	0	None	-	-	None	-	0	**Hot Spots:** None **Historical Review:** None **Structures with Index rating with a 5:** None
70-10	19	293-274	1	None	-	-	None	-	0	**Hot Spots:** None **Historical Review:** None **Structures with Index rating with a 5:** None
70-11	4	274-270	2	Low	-	-	Low	-	0	**Hot Spots:** None **Historical Review:** None **Structures with Index rating with a 5:** Peridot RR OP MP 271.27 (#477)

Segment	Segment Length (miles)	Segment Mileposts (MP)	Number of Bridges in Segment	Initial Need	Need Adjustments		Final Need	Historical Review	# Functionally Obsolete Bridges	Comments
					Hot Spots (Rating of 4 or multiple 5's)	Previous Projects (which supersede condition data)				
70-12	15	270-255	1	Low	-	**MP 259 (H8359):** Constructing concrete floors underneath the Gilson Wash Bridge (#464)	Low	-	0	**Hot Spots:** None **Historical Review:** None **Structures with Index rating with a 5:** None No change in Final Needs is warranted as recent projects do not address
70/60E-13	12	255-243	11	High	Pinal Creek Bridge MP 250.37 (#549),Pinal Creek Bridge MP 249.80 (#36),Pinal Creek Bridge MP 249.64 (#266),Bloody Tanks Bridge MP 243.71 (#173)	-	High	Pinal Creek Bridge MP 249.80 (#36),Pinal Creek Bridge MP 249.64 (#266)	1	**Hot Spots:** Bloody Tanks Bridge MP 243.71 (#173); Pinal Creek Bridge MP 249.64 (#266); Pinal Creek Bridge MP 249.80 (#36); Pinal Creek Bridge MP 250.37 (#549)**Historical Review:** Pinal Creek Bridge MP 249.80 (#36); Pinal Creek Bridge MP 249.64 (#266) **Structures with Index rating with a 5:** Bloody Tanks Bridge MP 243.71 (#173); Pinal Creek Bridge MP 249.64 (#266); Pinal Creek Bridge MP 249.80 (#36); Pinal Creek Bridge MP 250.37 (#549); Globe Viaduct MP 250.90 (#1787); MCMillen Wash Bridge MP 251.75 (#1028) **Programmed Projects:** Bloody Tanks Wash Bridge (MP 243.75); Pinal Creek Bridge (MP 249.8); Maple Street OP (MP 250.75); Southern Pacific Bridge (MP 253.75)No change in Final Needs is warranted as recent projects do not address segment needs
60E-14	16	243-227	5	High	Pinto Creek Bridge MP 238.25 (#351), Waterfall Canyon Bridge MP 229.50 (#328), Queen Creek Bridge MP 227.71 (#406) Queen Creek Tunnel MP 228.47 (#407)	**MP 238.25 (H8243):** Bridge Replacement Pinto Creek Bridge #351 **MP 229.48-241.93(H5818):** Bridge repair	High	Pinto Creek Bridge MP 238.25 (#351), Waterfall Canyon Bridge MP 229.50 (#328), Queen Creek Bridge MP 227.71 (#406)	0	**Hot Spots:** Queen Creek Bridge MP 227.71 (#406); Waterfall Canyon Bridge MP 229.50 (#328) **Historical Review:** Pinto Creek Bridge MP 238.25 (#351); Waterfall Canyon Bridge MP 229.50 (#328); Queen Creek Bridge MP 227.71 (#406) **Structures with Index rating with a 5:** Queen Creek Bridge MP 227.71 (#406); Queen Creek Tunnel MP 228.47 (#4491); Waterfall Canyon Bridge MP 229.50 (#328); Pinto Creek Bridge MP 238.25 (#351); Bloody Tanks Wash Bridge MP 242.72 (#45) **Programmed Projects:** Pinto Creek Bridge FY 2018 (MP 238) No change in Final Needs is warranted as recent projects do not fully address segment needs
60E-15	2	227-225	3	Low	-	**MP 225.00-226.87 (H7900):** New 4-lane rural divided and new 4-lane urban divided; Structure rehabilitation/ replacement	Low		2	**Hot Spots:** None **Historical Review:** None **Structures with Index rating with a 5:** None No change in Final Needs is warranted as recent projects do not fully address segment needs
60E-16	2	225-223	2	Medium	-	**MP 223-225 (H7900):** New 4-lane rural divided and new 4-lane urban divided; Structure rehabilitation/ replacement	None		0	**Hot Spots:** None **Historical Review:** None **Structures with Index rating with a 5:** Silver King Wash Bridge MP 223.70 (#318); Wash Bridge MP 224.64 (#319) A change for the Final Need is warranted due to completed projects
60E-17	11	223-212	7	Low		**MP 221.72-223 (H7900):** Structure rehabilitation/ replacement **MP 222.25 (H8566):** Bridge replacement project Queen Creek Bridge #296	Low		0	**Hot Spots:** None **Historical Review:** None **Structures with Index rating with a 5:** Queen Creek Bridge MP 222.25 (#296); Wash Bridge MP 222.87 (#288) No change in Final Needs is warranted as recent projects do not fully address segment needs

Figure 6: Bridge History

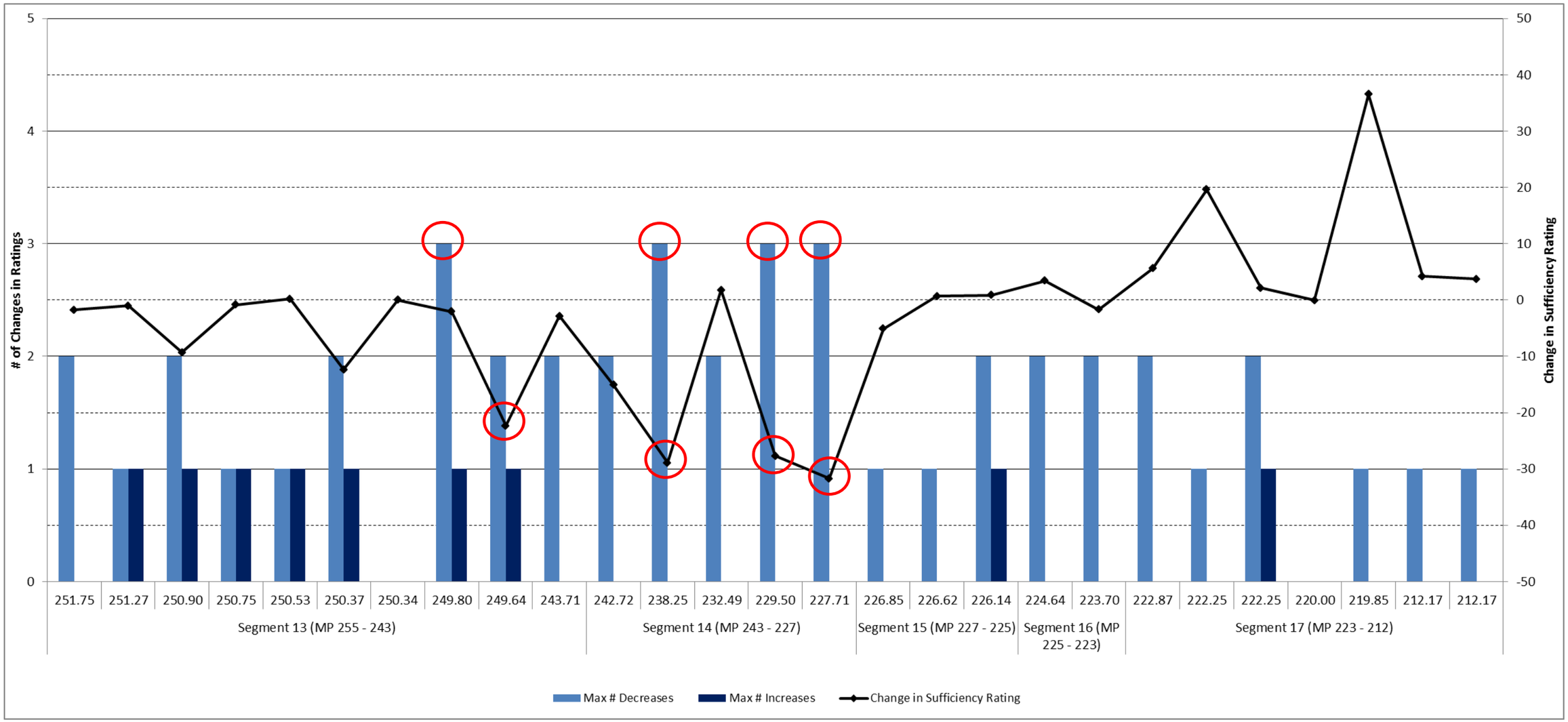


Identifies the bridge indicated is of concern from a historical ratings perspective

Maximum # Decreases: Maximum number of times that the Deck Rating, Substructure Rating, or Superstructure Rating decreased from 1997 to 2014. (Higher number could indicate a more dramatic decline in the performance of the bridge)

Maximum # Increases: Maximum number of times that the Deck Rating, Substructure Rating, or Superstructure Rating increased from 1997 to 2014. (Higher number could indicate a higher level of investment)

Change in Sufficiency Rating: Cumulative change in Sufficiency Rating from 1997 to 2014. (Bigger negative number could indicate a more dramatic decline in the performance of the bridge)



○ Identifies the bridge indicated is of concern from a historical ratings perspective

Maximum # Decreases: Maximum number of times that the Deck Rating, Substructure Rating, or Superstructure Rating decreased from 1997 to 2014. (Higher number could indicate a more dramatic decline in the performance of the bridge)

Maximum # Increases: Maximum number of times that the Deck Rating, Substructure Rating, or Superstructure Rating increased from 1997 to 2014. (Higher number could indicate a higher level of investment)

Change in Sufficiency Rating: Cumulative change in Sufficiency Rating from 1997 to 2014. (Bigger negative number could indicate a more dramatic decline in the performance of the bridge)

Table 7: Bridge Needs Contributing Factors (Step 3)

Segment	Segment Length (Miles)	Segment Mileposts (MP)	Number of Bridges in Segment	# Functionally Obsolete Bridges	Final Need	Contributing Factors			Comments
						Bridge	Current Ratings	Historical Review	
191-1	24	0-24	1	0	None	None			
191-2	43	24-67	2	0	Medium	Cochise UPRR OP (No. 157 MP 62.88)	Deck=5	Not identified through Historical Review	
191-3	17	87-104	2	0	Low	Monk Draw Bridge SB (No. 292 MP 89.28)	Evaluation=5	Not identified through Historical Review	
191-4	12	104-116	1	0	Low	None			
191-5	5	116-121	0	0	None	No bridges within segment			
70-6	9	339-330	1	0	Low	None			
70-7	19	330-300	8	0	Low	Hunzinger Wash Bridge (No. 561 MP 313.62)	Superstructure=5; Evaluation=5	Not identified through Historical Review	
						Black Rock Wash Bridge (No. 515 MP 306.76)	Superstructure=5; Evaluation=5	Identified through Historical Review	
						Holyoak Wash Bridge (No. 514 MP 302.53)	Deck=5; Substructure=5; Superstructure=5; Evaluation=5	Not identified through Historical Review	
70-8	2	300-298	1	0	None	None			
70-9	5	298-293	0	0	None	No bridges within segment			
70-10	19	293-274	1	0	None	None			
70-11	4	274-270	2	0	Low	Peridot RR OP (No. 477 MP 271.27)	Deck=5	Not identified through Historical Review	
70-12	15	270-255	1	0	Low	None			
70/60E-13	12	255-243	11	1	High	McMillen Wash Bridge (No 1028 MP 251.75)	Superstructure=5; Evaluation=5	Not identified through Historical Review	
						Globe Viaduct (No. 1787 MP 250.90)	Deck=5	Not identified through Historical Review	
						Pinal Creek Bridge (No. 549 MP 250.37)	Deck=5; Substructure=5; Evaluation=5	Not identified through Historical Review	
						Pinal Creek Bridge (No. 36 MP 249.80)	Deck=5; Substructure=5; Evaluation=5	Identified through Historical Review	
						Pinal Creek Bridge (No. 266 MP 249.64)	Deck=4; Substructure=4; Superstructure=5; Evaluation=4	Identified through Historical Review	
						Bloody Tanks Bridge (No. 173 MP 243.71)	Deck=5; Substructure=5; Evaluation=5	Not identified through Historical Review	

Segment	Segment Length (Miles)	Segment Mileposts (MP)	Number of Bridges in Segment	# Functionally Obsolete Bridges	Final Need	Contributing Factors			Comments
						Bridge	Current Ratings	Historical Review	
60E-14	16	243-227	5	0	High	Bloody Tanks Wash Bridge (No. 45 MP 242.72)	Superstructure=5; Evaluation=5	Not identified through Historical Review	
						Pinto Creek Bridge (No. 351 MP 238.25)	Deck=4; Substructure=4; Superstructure=4; Evaluation=4	Identified through Historical Review	
						Waterfall Canyon Bridge (No. 328 MP 229.50)	Substructure=5; Superstructure=4; Evaluation=4	Identified through Historical Review	
						Queen Creek Bridge (No. 406 MP 227.71)	Deck=4; Substructure=4; Superstructure=4; Evaluation=4	Identified through Historical Review	
60E-15	2	227-225	3	2	Low	None			
60E-16	2	225-223	2	0	None	Wash Bridge (No. 319 MP 224.64)	Evaluation=5	Not identified through Historical Review	
						Silver King Wash Bridge (No. 318 MP 223.70)	Evaluation=5	Not identified through Historical Review	
60E-17	11	223-212	7	0	Low	Wash Bridge (No. 288 MP 222.87)	Evaluation=5	Not identified through Historical Review	
						Queen Creek Bridge WB (No. 296 MP 222.25)	Superstructure=5; Evaluation=5	Not identified through Historical Review	

5.0 MOBILITY PERFORMANCE AREA NEEDS (STEPS 1-3)

The following sections describe Steps 1 through 3 of the Needs Assessment process for the US 60|US 70|US 191 corridor for the Mobility Performance Area. The methodology for performing Steps 1 through 3 is provided in **Appendix A**.

5.1 Step 1: Initial Mobility Needs

The baseline performance scores (from Working Paper 2) and performance objectives (from Working Paper 3) for the US 60|US 70|US 191 corridor were used to determine the initial mobility needs, as described in Section 2.1. The mobility condition data used to calculate baseline performance was provided by ADOT for 2014 for the existing traffic volumes and travel time data, 2014 for bicycle accommodation data, 2035 for future traffic volumes, and 2010-2014 for the closure data.

Step 1 uses the scores for the Mobility Index primary performance measure and six secondary performance measures to determine the level of need for each performance measure by segment. The six secondary performance measures are Future Daily Volume-to-Capacity (V/C), Existing Directional Peak Hour V/C, Directional Closure Extent, Directional Travel Time Index (TTI), Directional Planning Time Index (PTI), and Bicycle Accommodation.

The performance scores, performance objectives, and initial levels of need for each mobility performance measure and for all mobility performance measures combined are shown in **Table 8**.

For the Mobility Index, Future Daily V/C, and Existing Directional Peak Hour V/C, only one segment report a high level of need, while one additional segment reported medium for Future Daily V/C. For Directional Closure Extent, one segment reports a medium level of need and one a low level of need in the NB/WB direction, and two segments report a high level of need in the SB/EB direction. For Directional TTI, one segment reports a high level of need in the NB/WB direction. For Directional PTI, in the NB/WB direction four segments report a high level of need, one segment a medium level of need, and one a low level of need, while in the SB/EB direction four segments reported a high level of need, one segment with a medium level of need, and one segment with a low level of need. For Bicycle Accommodation, ten segments report a high level of need, two segments report a medium level of need, and one segment reported a low level of need. For all mobility performance measures combined, one segment report a high level of initial need, one segment reported a medium level of initial need, and thirteen segments reported a low level of need.

5.2 Step 2: Final Mobility Needs

Once the initial mobility needs by segment for the US 60|US 70|US 191 corridor were established, they were then refined in Step 2 as described in Section 2.2 to more accurately reflect existing needs. An evaluation of relevant recently completed and under-construction projects was performed to determine if segment need levels required adjustment. The initial needs were then refined based on this assessment to determine the final need for each segment. Planned and programmed future projects were noted for future reference in developing solutions that address identified needs. The Step 2 process is described in more detail below and summarized in **Table 9**.

Recently Completed and Under-Construction Mobility Projects

ADOT provided information on potentially relevant recently completed and under-construction projects that were not previously reflected in the baseline performance data. This includes any projects completed or under construction after 2014 that have the potential to mitigate a mobility need on a corridor segment.

There are seven segments containing a recently completed project which would supersede the mobility condition data, as shown in **Table 9**. three segments include projects which address the identified mobility needs. As such, adjustments were made to the need level of these segments to account for recently completed or under-construction projects.

Planned or Programmed Projects

Information was noted in **Table 9** on mobility-related planned and programmed projects and other issues identified in previous reports in Working Paper 1. Planned and programmed projects and identified issues do not influence the level of need, but were documented for future reference in developing solutions that address identified needs.

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Table 8: Initial Mobility Needs (Step 1)

Segment	Segment Mileposts	Segment Length (miles)	Environment Type	Facility Operation	Mobility Index			Future Daily V/C			Existing Peak Hour V/C					Closure Extent (occurrences/year/mile)				
					Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	Performance Score		Performance Objective	Level of Need		Performance Score		Performance Objective	Level of Need	
											NB/WB	SB/EB		NB/WB	SB/EB	NB/WB	SB/EB		NB/WB	SB/EB
191-1	0-24	24	Rural	Interrupted	0.15	Fair or Better	None	0.17	Fair or Better	None	0.12	0.12	Fair or Better	None	None	0.03	0.01	Fair or Better	None	None
191-2	24-67	43	Rural	Interrupted	0.09	Fair or Better	None	0.10	Fair or Better	None	0.07	0.07	Fair or Better	None	None	0.02	0.00	Fair or Better	None	None
191-3	87-104	17	Rural	Uninterrupted	0.04	Fair or Better	None	0.04	Fair or Better	None	0.03	0.03	Fair or Better	None	None	0.01	0.00	Fair or Better	None	None
191-4	104-116	12	Urban	Uninterrupted	0.18	Fair or Better	None	0.20	Fair or Better	None	0.14	0.14	Fair or Better	None	None	0.03	0.03	Fair or Better	None	None
191-5	116-121	5	Urban	Interrupted	0.33	Fair or Better	None	0.39	Fair or Better	None	0.27	0.28	Fair or Better	None	None	0.12	0.08	Fair or Better	None	None
70-6	330-339	9	Urban	Interrupted	0.53	Fair or Better	None	0.69	Fair or Better	None	0.32	0.32	Fair or Better	None	None	0.02	0.06	Fair or Better	None	None
70-7	330-300	19	Rural	Uninterrupted	0.18	Fair or Better	None	0.21	Fair or Better	None	0.13	0.13	Fair or Better	None	None	0.02	0.00	Fair or Better	None	None
70-8	300-298	2	Rural	Uninterrupted	0.12	Fair or Better	None	0.15	Fair or Better	None	0.08	0.08	Fair or Better	None	None	0.00	0.10	Fair or Better	None	None
70-9	298-293	5	Urban	Uninterrupted	0.25	Fair or Better	None	0.29	Fair or Better	None	0.16	0.17	Fair or Better	None	None	0.00	0.04	Fair or Better	None	None
70-10	293-274	19	Rural	Uninterrupted	0.17	Fair or Better	None	0.19	Fair or Better	None	0.11	0.11	Fair or Better	None	None	0.09	0.04	Fair or Better	None	None
70-11	274-270	4	Urban	Uninterrupted	0.21	Fair or Better	None	0.26	Fair or Better	None	0.12	0.12	Fair or Better	None	None	0.10	0.00	Fair or Better	None	None
70-12	270-255	15	Rural	Uninterrupted	0.19	Fair or Better	None	0.23	Fair or Better	None	0.13	0.13	Fair or Better	None	None	0.04	0.31	Fair or Better	None	None
70/60E-13	255-243	12	Urban	Interrupted	0.40	Fair or Better	None	0.46	Fair or Better	None	0.29	0.30	Fair or Better	None	None	0.00	0.12	Fair or Better	None	None
60E-14	243-227	16	Rural	Uninterrupted	1.73	Fair or Better	High	2.11	Fair or Better	High	1.22	1.09	Fair or Better	High	High	0.33	1.57	Fair or Better	None	High
60E-15	227-225	2	Urban	Uninterrupted	0.43	Fair or Better	None	0.60	Fair or Better	None	0.20	0.20	Fair or Better	None	None	0.36	1.17	Fair or Better	Low	High
60E-16	225-223	2	Rural	Uninterrupted	0.54	Fair or Better	None	0.71	Fair or Better	Medium	0.28	0.28	Fair or Better	None	None	0.50	0.00	Fair or Better	Medium	None
60E-17	223-212	11	Rural	Interrupted	0.20	Fair or Better	None	0.26	Fair or Better	None	0.11	0.10	Fair or Better	None	None	0.09	0.05	Fair or Better	None	None
Mobility Emphasis Area?		**Yes**	**Corridor Weighted Average**		**0.30**	**Good**	**None**													

Table 8: Initial Mobility Needs (Step 1), (continued)

Segment	Segment Mileposts	Segment Length (miles)	Environment Type	Facility Operation	Directional TTI (all vehicles)					Directional PTI (all vehicles)					Bicycle Accommodation			Initial Need
					Performance Score		Performance Objective	Level of Need		Performance Score		Performance Objective	Level of Need		Performance Score	Performance Objective	Level of Need	
					NB/WB	SB/EB		NB/WB	SB/EB	NB/WB	SB/EB		NB/WB	SB/EB				
191-1	0-24	24	Rural	Interrupted	1.51	1.30	Fair or Better	None	None	4.79	7.47	Fair or Better	Low	High	66%	Fair or Better	Medium	Low
191-2	24-67	43	Rural	Interrupted	1.16	1.16	Fair or Better	None	None	9.83	6.09	Fair or Better	High	Medium	0%	Fair or Better	High	Low
191-3	87-104	17	Rural	Uninterrupted	1.39	1.20	Fair or Better	High	None	9.51	11.62	Fair or Better	High	High	49%	Fair or Better	High	Medium
191-4	104-116	12	Urban	Uninterrupted	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	96%	Fair or Better	None	None
191-5	116-121	5	Urban	Interrupted	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	27%	Fair or Better	High	Low
70-6	330-339	9	Urban	Interrupted	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	46%	Fair or Better	High	Low
70-7	330-300	19	Rural	Uninterrupted	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	73%	Fair or Better	Low	Low
70-8	300-298	2	Rural	Uninterrupted	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	0%	Fair or Better	High	Low
70-9	298-293	5	Urban	Uninterrupted	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	26%	Fair or Better	High	Low
70-10	293-274	19	Rural	Uninterrupted	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	4%	Fair or Better	High	Low
70-11	274-270	4	Urban	Uninterrupted	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	4%	Fair or Better	High	Low
70-12	270-255	15	Rural	Uninterrupted	Insufficient Data	1.10	Fair or Better	N/A	None	Insufficient Data	1.40	Fair or Better	N/A	Low	23%	Fair or Better	High	Low
70/60E-13	255-243	12	Urban	Interrupted	1.15	1.31	Fair or Better	None	None	2.72	3.36	Fair or Better	None	None	54%	Fair or Better	Medium	Low
60E-14	243-227	16	Rural	Uninterrupted	1.07	1.19	Fair or Better	None	None	1.47	2.06	Fair or Better	Medium	High	49%	Fair or Better	High	High
60E-15	227-225	2	Urban	Uninterrupted	1.08	1.17	Fair or Better	None	None	1.67	2.30	Fair or Better	High	High	95%	Fair or Better	None	Low
60E-16	225-223	2	Rural	Uninterrupted	1.09	1.00	Fair or Better	None	None	1.91	1.04	Fair or Better	High	None	87%	Fair or Better	None	Low
60E-17	223-212	11	Rural	Interrupted	1.01	1.01	Fair or Better	None	None	1.16	1.24	Fair or Better	None	None	96%	Fair or Better	None	None

Table 9: Final Mobility Needs (Step 2)

Segment	Segment Mileposts (MP)	Segment Length (miles)	Initial Need	Need Adjustments	Final Need	Planned and Programmed Future Projects
				Recent Projects Since 2014		
191-1	0-24	24	Low	None	Low	Additional future planned projects or recommendations include: DMS NB/SB MP 2
191-2	24-67	43	Low	**MP 37.97-45.80:** Roadway excavation and borrow for widening of shoulders	Low	Additional future planned projects or recommendations include: Reconstruct I-10 Interchange MP 67.5. Although there has been a recently completed project, it does not address the issues associated with the initial need.
191-3	87-104	17	Medium	None	Medium	Additional future planned projects or recommendations include: I-10 to US 70 Reconstruct to 4 lane divided MP 87-104*; DMS SB MP 90
191-4	104-116	12	None	None	None	Additional future planned projects or recommendations include: I-10 to US 70 Reconstruct to 4 lane divided MP 104-116*; US 191 alternate route MP 104-116; Restripe to 5 lanes MP 110.9-116; Pavement preservation MP 114-116
191-5	116-121	5	Low	None	Low	Additional future planned projects or recommendations include: I-10 to US 70 Reconstruct to 4 lane divided MP 116-121*; US 191 alternate route MP 116-121; Restripe to 5 lanes MP 116-118/120-121; Pavement preservation MP 116-118; DMS NB MP 116; Sidewalk and intersection improvement projects MP 120-121
70-6	330-339	9	Low	None	Low	Additional future planned projects or recommendations include: Widen roadway MP 330-339*; Concrete sidewalk and pedestrian bridge parallel to US 70 MP 330-335; Intersection improvements MP 337-339
70-7	330-300	19	Low	None	Low	Additional future planned projects or recommendations include: Widen roadway MP 300-330*; Construct Pedestrian Bridge MP 329-330; Add center turn lane MP 312.25
70-8	300-298	2	Low	None	Low	Additional future planned projects or recommendations include: Widen roadway MP 298-300*; Pathway and intersection improvements MP 291-300
70-9	298-293	5	Low	None	Low	Additional future planned projects or recommendations include: Widen roadway MP 293-298*; Eliminate passing zone MP 294.6-295.5; Continuous two-way left turn lane MP 294-298; Eliminate passing zone MP 296.5-297.7
70-10	293-274	19	Low	None	Low	Additional future planned projects or recommendations include: Widen roadway MP 274-293*; Climbing lane MP 282-288
70-11	274-270	4	Low	**MP 270-271.27:** Construct a 6 foot wide asphalt pathway, concrete sidewalk and pedestrian lighting	Low	Additional future planned projects or recommendations include: Widen roadway MP 270-274*; Construct passing lane MP 270-271. No change was warranted for the segment since the recent projects completed span less than half the distance of the segment.
70-12	270-255	15	Low	**MP 255.30-270:** Construct 6 foot wide asphalt pathway, concrete sidewalk and pedestrian lighting	Low	Additional future planned projects or recommendations include: Widen roadway MP 255-270*; Intersection improvement MP 260; Climbing lane MP 262-264; Construct passing lane MP 267-270. Although the recently completed project addresses mobility needs, it does not address the on-street bicycle accommodation therefore the level of need was not changed.
70/60E-13	255-243	12	Low	None	Low	Additional future planned projects or recommendations include: Construct Alternative Alignment MP 243-252; Speed limit study MP 243-252; Construct Sidewalk MP 243-252; Widen to four lane MP 243-254; Access management MP 243-245.5/246.5-247; Turn lanes MP 244.5; Restripe to five lane MP 244-244.25; Intersection Improvement 244.6; DMS EB MP 247; Widen roadway MP 253-255*; DMS EB MP 253; Intersection Study MP 254; Paved Shoulder 243-252

*BQAZ

Segment	Segment Mileposts (MP)	Segment Length (miles)	Initial Need	Need Adjustments Recent Projects Since 2014	Final Need	Planned and Programmed Future Projects
60E-14	243-227	16	High	**MP 229.48-241.93 (H5818)**: Construct climbing and passing lanes	Medium	Additional future planned projects or recommendations include: Construct Alternative Alignment MP 227-243; Paved Shoulder MP 227-243; Shoulder improvements EB/WB MP 227-242; Widen to four lane MP 235.5-243; Construct Ped Bridge Extension MP 239-240; Realign Intersection MP 242 An adjustment for the Final Need was warranted based on projects completed or under construction which supersede performance data.
60E-15	227-225	2	Low	**MP 225-226.87 (H7900):** Reconstructing the existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	None	No additional future planned projects or recommendations were identified. An adjustment for the Final Need was warranted based on projects completed or under construction which supersede performance data.
60E-16	225-223	2	Low	**MP 223-225 (H7900):** Reconstructing the existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	None	No additional future planned projects or recommendations were identified. An adjustment for the Final Need was warranted based on projects completed or under construction which supersede performance data.
60E-17	223-212	11	None	**MP 221.72-223 (H7900):** Reconstructing the existing two-lane undivided roadway into a four-lane divided highway andreconstructing the existing three-lane roadway into a four-lane roadway with a raised median	None	Additional future planned projects or recommendations include: Construct Alternative Alignment MP 212-223; Construct new WB lanes MP 216.3-219.9; New Queen Valley TI MP 215-214; Construct new EB lanes MP 219.9-222.3

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5.3 Step 3: Mobility Contributing Factors

As described in Section 2.3, Step 3 identifies potential contributing factors to the performance needs calculated in Step 2. These contributing factors provide information on what types of improvements may help improve performance. Contributing factors include:

- Roadway variables
- Traffic variables
- Relevant freight-related existing infrastructure
- Closure type
- Non-actionable conditions

Roadway Variables

Roadway variables include functional classification, environmental type (e.g., urban, rural), terrain, number of lanes, speed limit, presence of auxiliary lanes, if a roadway is divided or non-divided, and how often passing is not allowed. These variables are described in more detail below:

- Functional classification indicates if a roadway is an interstate, state highway, or arterial. Capacity equations and parameters differ depending on a roadway's functional classification.
- Environmental type refers to how developed the land is adjacent to the roadway. Environmental types include urban, fringe urban, and rural. Capacity thresholds differ depending on the environmental type as higher congestion levels are more acceptable in urbanized areas than in rural areas.
- Terrain (described as level, rolling, or mountainous) indicates the general roadway grade, which influences how quickly vehicles can accelerate or decelerate or maintain a constant speed.
- The number of lanes in each direction indicates how many general purpose through lanes exist.
- The speed limit indicates the posted speed limit.
- The presence of auxiliary lanes for turning, weaving, or passing can improve mobility performance by maintaining more consistent speeds in mainline through lanes.
- A roadway is considered divided if it has a raised or depressed median separating the directions of traffic that cannot easily be traversed. A roadway with a painted paved median is considered a non-divided roadway. Dividing a roadway generally increases the roadway capacity.
- The presence of no-passing zones restricts the movement of vehicles around slower-moving vehicles.

Traffic Variables

Traffic variables include existing and future level of service (LOS), percent (%) trucks, and the buffer index (difference between PTI and TTI). The existing and future LOS, percentage of trucks, and buffer index can indicate how well a corridor is performing in terms of overall mobility and why certain segments of a corridor may be performing worse than others.

Existing and Future LOS

The existing and future LOS provide a letter "grade" between "A" and "F" for mobility that is generally reflective of Existing and Future V/C calculations. LOS values of "A", "B", and "C" are generally considered highly acceptable. A LOS value of "D" is generally considered moderately acceptable. LOS values of "E" and "F" are generally considered unacceptable.

Truck Traffic

The amount of truck traffic in a given segment of the corridor can be represented as a percentage of the overall total traffic volume for that specific segment. The truck volume on a corridor can impact overall mobility based on truck travel speed, corridor grades, required inspection points and number of lanes.

Buffer Index

The Buffer Index is calculated by subtracting the segment level TTI value (ratio of peak hour speed to free flow speed) from the segment level PTI value (95th percentile speed). The TTI and PTI values were determined in Working Paper 2. The buffer index expresses the amount of extra time necessary to be on-time 95 percent of the time for any given trip. This calculation provides information on the reliability of a corridor.

Mobility-Related Infrastructure

Mobility-related infrastructure refers to devices or features at specific locations that influence mobility performance. Examples include dynamic message signs (DMS), passing lanes, climbing lanes, ports of entry (POE), rest areas, and parking areas.

Closure Type

The relative frequency of types of closures within each segment helps indicate potential causes of mobility-related needs. Closure types consist of closures due to an incident/crash, obstruction, or weather condition. The number of each type of closure and the corresponding percentage of all closures that are of each type are noted.

Non-Actionable Conditions

Non-actionable conditions are features or characteristics that result in poor mobility performance that cannot be addressed through an engineered solution. Examples include border patrol checkpoints that require all vehicles to slow down or stop for inspection.

Mobility Needs Contributing Factors

Table 10 summarizes the potential contributing factors to mobility needs on the US 60|US 70|US 191 corridor.

Table 10: Mobility Needs Contributing Factors (Step 3)

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Roadway Variables								Traffic Variables					Relevant Mobility Related Existing Infrastructure
				Functional Classification	Environmental Type (Urban/Rural)	Terrain	# of Lanes/ Direction	Speed Limit	Aux Lanes	Divided/ Non-Divided	% No Passing	Existing LOS	Future 2035 LOS	% Trucks	NB Buffer Index (PTI-TTI)	SB Buffer Index (PTI-TTI)	
191-1	0-24	24	Low	State Highway	Rural	Level	2	55	No	Non-Divided	12%	A/B	A/B	17%	3.28	6.17	Rest Area MP 0
191-2	24-67	43	Low	State Highway	Rural	Level	2	55	No	Non-Divided	26%	A/B	A/B	17%	8.67	4.93	Border Patrol Check Point MP 43 NB
191-3	87-104	17	Medium	State Highway	Rural	Level	4	55	No	Divided	3%	A/B	A/B	17%	8.12	10.43	None
191-4	104-116	12	None	State Highway	Fringe Urban	Level	4	65	No	Non-Divided	30%	A-C	A-C	17%	No Data	No Data	None
191-5	116-121	5	Low	State Highway	Urban	Level	4	40	No	Non-Divided	13%	A-C	A-C	17%	No Data	No Data	None
70-6	330-339	9	Low	State Highway	Urban	Level	4	40	No	Non-Divided	0%	A-C	A-C	5%	No Data	No Data	Rest Area MP 339; Permanent Traffic Counter MP 337
70-7	330-300	19	Low	State Highway	Rural	Level	2	55	No	Non-Divided	13%	A/B	A/B	5%	No Data	No Data	None
70-8	300-298	2	Low	State Highway	Rural	Level	2	65	No	Non-Divided	6%	A/B	A/B	5%	No Data	No Data	None
70-9	298-293	5	Low	State Highway	Fringe Urban	Level	2	50	No	Non-Divided	53%	A-C	A-C	5%	No Data	No Data	Rest Area MP 296
70-10	293-274	19	Low	State Highway	Rural	Level	2	55	No	Non-Divided	37%	A/B	A/B	5%	No Data	No Data	None
70-11	274-270	4	Low	State Highway	Fringe Urban	Level	2	55	No	Non-Divided	77%	A-C	A-C	5%	No Data	No Data	None
70-12	270-255	15	Low	State Highway	Rural	Level	2	60	No	Non-Divided	10%	A/B	A/B	11%	No Data	0.31	Climbing/Passing Lane MP 263-260; Permanent Traffic Counter MP 259;
70/60E-13	255-243	12	Low	State Highway	Urban	Level	4	45	No	Non-Divided	0%	A-C	A-C	12%	1.56	2.05	CCTV MP 254; Permanent Traffic Counter MP 252;
60E-14	243-227	16	Medium	State Highway	Rural	Mountainous	2	50	No	Non-Divided	68%	D-F	D-F	14%	0.40	0.87	Climbing/Passing Lane 241-236/233-234/232-228
60E-15	227-225	2	None	State Highway	Urban	Rolling	2	45	No	Non-Divided	98%	A-C	A-C	14%	0.60	1.13	Rest Area MP 226
60E-16	225-223	2	None	State Highway	Rural	Level	2	55	No	Non-Divided	55%	A/B	D-F	14%	0.83	0.04	None
60E-17	223-212	11	None	State Highway	Rural	Level	4	65	No	Divided	11%	A/B	A/B	13%	0.15	0.23	None

Table 10: Mobility Needs Contributing Factors (Step 3) (continued)

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Closure Extent							Non-Actionable Conditions	Programmed and Planned Projects or Issues from Previous Documents Relevant to Final Need	Contributing Factors
				Total Number of Closures	# Incidents/ Accidents	% Incidents/ Accidents	# Obstructions/ Hazards	% Obstructions/ Hazards	# Weather Related	% Weather Related			
191-1	0-24	24	Low	3	3	100%	0	0%	0	0%	None	DMS NB/SB MP 2	- This segment includes one rest area - 100% of closures were related to incidents/accidents - 1 crash was fatal - Key characteristics of the incidents/accidents for this segment are: 75% involve collisions with other motor vehicles, 50% involve inattention/distraction, and 50% occur in daylight condition. -Segment averages 7 access points per mile
191-2	24-67	43	Low	5	3	60%	2	40%	0	0%	Border Patrol Check Point MP 43 NB	Reconstruct I-10 Interchange MP 67.5. Recently completed project does not address the issues associated with the initial need.	- This segment includes a Border Patrol Check Point effecting NB traffic - Approximately 30% of this segment has pavement failure - 60% of closures were related to incidents/accidents - 1 crash was fatal - Key characteristics of the incidents/accidents for this segment are: 67% involve collisions with other motor vehicles, 33% involve inattention/distraction, and occur 100% in daylight conditions. -Segment averages 8 access points per mile
191-3	87-104	17	Medium	1	1	100%	0	0%	0	0%	None	I-10 to US 70 Reconstruct to 4 lane divided MP 87-104*; DMS SB MP 90	- 100% of closures were related to incidents/accidents - 2 crashes were fatal - Key characteristics of the incidents/accidents for this segment are: 100% involve overturning, 100% involve speed too fast for conditions, and 100% involve dry conditions. -Segment averages 2 access points per mile
191-4	104-116	12	None	4	4	100%	0	0%	0	0%	None	I-10 to US 70 Reconstruct to 4 lane divided MP 104-116*; US 191 alternate route MP 104-116; Restripe to 5 lanes MP 110.9-116; Pavement preservation MP 114-116	- 100% of closures were related to incidents/accidents - Key characteristics of the incidents/accidents for this segment are: 100% involve collisions with other motor vehicles, 100% failure to yield right-of-way, and 100% occur in dark-unlighted conditions. -Segment averages 13 access points per mile
191-5	116-121	5	Low	5	5	100%	0	0%	0	0%	None	I-10 to US 70 Reconstruct to 4 lane divided MP 116-121*; US 191 alternate route MP 116-121; Restripe to 5 lanes MP 116-118/120-121; Pavement preservation MP 116-118; DMS NB MP 116; Sidewalk and intersection improvement projects MP 120-121	- 100% of closures were related to incidents/accidents - 2 crashes were fatal - Key characteristics of the incidents/accidents for this segment are: 60% involve collisions with other motor vehicles, 40% failure to yield right-of-way, and 40% occur in dark-unlighted conditions.

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Closure Extent							Non-Actionable Conditions	Programmed and Planned Projects or Issues from Previous Documents Relevant to Final Need	Contributing Factors
				Total Number of Closures	# Incidents/ Accidents	% Incidents/ Accidents	# Obstructions/ Hazards	% Obstructions/ Hazards	# Weather Related	% Weather Related			
70-6	330-339	9	Low	2	2	100%	0	0%	0	0%	None	Additional planned projects or recommendations include: Widen roadway MP 330-339*; Concrete sidewalk and pedestrian bridge parallel to US 70 MP 330-335; Intersection improvements MP 337-339	- This segment includes one rest area - 100% of closures were related to incidents/accidents - 2 crashes were fatal - Key characteristics of the incidents/accidents for this segment are: 100% involve collisions with other motor vehicles, 30% involve inattention/distraction, and 80% occur in daylight conditions.
70-7	330-300	19	Low	3	3	100%	0	0%	0	0%	None	Additional planned projects or recommendations include: Widen roadway MP 300-330*; Construct Pedestrian Bridge MP 329-330; Add center turn lane MP 312.25	- 100% of closures were related to incidents/accidents - Key characteristics of the incidents/accidents for this segment are: 50% involve overturning, 25% involve speed too fast for conditions, and 100% occur in dark-unlighted conditions. -Segment averages 9 access points per mile
70-8	300-298	2	Low	1	0	0%	1	100%	0	0%	None	Additional planned projects or recommendations include: Widen roadway MP 298-300*; Pathway and intersection improvements MP 291-300	- 100% of closures were related to obstruction -Segment averages 7 access points per mile
70-9	298-293	5	Low	1	1	100%	0	0%	0	0%	None	Additional planned projects or recommendations include: Widen roadway MP 293-298*; Eliminate passing zone MP 294.6-295.5; Continuous two-way left turn lane MP 294-298; Eliminate passing zone MP 296.5-297.7	- This segment includes one rest area - 100% of closures were related to incidents/accidents - 1 crash was fatal - Key characteristics of the incidents/accidents for this segment are: 100% involve collisions with a pedestrian, 50% involve no improper action, and 100% occur in dark-unlighted conditions. -Segment averages 14 access points per mile

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Closure Extent							Non-Actionable Conditions	Programmed and Planned Projects or Issues from Previous Documents Relevant to Final Need	Contributing Factors
				Total Number of Closures	# Incidents/ Accidents	% Incidents/ Accidents	# Obstructions/ Hazards	% Obstructions/ Hazards	# Weather Related	% Weather Related			
70-10	293-274	19	Low	6	6	100%	0	0%	0	0%	None	Widen roadway MP 274-293*; Climbing lane MP 282-288	- 100% of closures were related to incidents/accidents - 5 crashes were fatal - Key characteristics of the incidents/accidents for this segment are: 40% involve collisions with other motor vehicles, 40% involve drove in opposing lane, and 40% occur in dark-unlighted conditions. -Segment averages 2 access points per mile
70-11	274-270	4	Low	2	2	100%	0	0%	0	0%	None	Widen roadway MP 270-274*; Construct passing lane MP 270-271. No change was warranted for the segment since the recent projects completed span less than half the distance of the segment.	- 100% of closures were related to incidents/accidents - 1 crashes were fatal - Key characteristics of the incidents/accidents for this segment are: 100% involve collisions with pedestrian, and 100% occur in dark-unlighted conditions. -Segment averages 9 access points per mile
70-12	270-255	15	Low	7	7	100%	0	0%	0	0%	None	Widen roadway MP 255-270*; Intersection improvement MP 260; Climbing lane MP 262-264; Construct passing lane MP 267-270. A change for the final need was warranted for the segment. The initial level of need can be attributed to the high level of need for bicycle accommodation. The recently completed project extends through a majority of the segment and addresses the high level of need for bicycle accommodation.	- This segment includes a climbing/passing lane - 100% of closures were related to incidents/accidents - 4 crashes were fatal - Key characteristics of the incidents/accidents for this segment are: 50% involve collisions with pedestrian, 25% involve no improper action, and 25% occur in dark-unlighted conditions. -Segment averages 4 access points per mile
70/60E-13	255-243	12	Low	3	2	67%	1	33%	0	0%	None	Construct Alternative Alignment MP 243-252; Speed limit study MP 243-252; Construct Sidewalk MP 243-252; Widen to four lane MP 243-254; Access management MP 243-245.5/246.5-247; Turn lanes MP 244.5; Restripe to five lane MP 244-244.25; Intersection Improvement 244.6; DMS EB MP 247; Widen roadway MP 253-255*; DMS EB MP 253; Intersection Study MP 254; Paved Shoulder 243-252	- 67% of closures were related to incidents/accidents - 8 crashes were fatal - Key characteristics of the incidents/accidents for this segment are: 66% involve collisions with other motor vehicle, 26% involve failure to yield right-of-way, and 63% occur in daylight conditions.

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Closure Extent							Non-Actionable Conditions	Programmed and Planned Projects or Issues from Previous Documents Relevant to Final Need	Contributing Factors
				Total Number of Closures	# Incidents/ Accidents	% Incidents/ Accidents	# Obstructions/ Hazards	% Obstructions/ Hazards	# Weather Related	% Weather Related			
60E-14	243-227	16	Medium	47	39	83%	4	9%	4	9%	None	Construct Alternative Alignment MP 227-243; Paved Shoulder MP 227-243; Shoulder improvements EB/WB MP 227-242; Widen to four lane MP 235.5-243; Construct Ped Bridge Extension MP 239-240; Realign Intersection MP 242 An adjustment for the Final Need was warranted based on projects completed or under construction which supersede performance data	- Mountainous terrain - 83% of closures were related to incidents/accidents - 9 crashes were fatal - Key characteristics of the incidents/accidents for this segment are: 38% involve fixed object, 66% involve speed too fast for conditions, and 69% occur in daylight conditions. -Segment averages 4 access points per mile
60E-15	227-225	2	None	9	6	67%	0	0%	3	33%	None	No additional planned projects or recommendations were identified	- This segment includes one rest area - 67% of closures were related to incidents/accidents - 1 crash was fatal - Key characteristics of the incidents/accidents for this segment are: 50% involve collisions with pedestrian, 25% involve no improper action, and 50% occur in daylight conditions.
60E-16	225-223	2	None	5	5	100%	0	0%	0	0%	None	No additional planned projects or recommendations were identified	- 100% of closures were related to incidents/accidents - Key characteristics of the incidents/accidents for this segment are: 100% involve collision with motor vehicle, 100% involve drove in opposing lane, and 100% occur in daylight conditions -Segment averages 7 access points per mile
60E-17	223-212	11	None	8	8	100%	0	0%	0	0%	None	Construct Alternative Alignment MP 212-223; Construct new WB lanes MP 216.3-219.9; New Queen Valley TI MP 215-214; Construct new EB lanes MP 219.9-222.3	- 100% of closures were related to incidents/accidents - 2 crashes were fatal - Key characteristics of the incidents/accidents for this segment are: 50% involve collision with motor vehicle, 42% involve speed too fast for conditions, and 67% occur in daylight conditions. -Segment averages 2 access points per mile

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6.0 SAFETY PERFORMANCE NEEDS (STEPS 1-3)

The following sections describe Steps 1 through 3 of the Needs Assessment process for the US 60|US 70|US 191 corridor for the Safety Performance Area. The methodology for performing Steps 1 through 3 is provided in **Appendix A**.

6.1 Step 1: Initial Safety Needs

The baseline performance scores (from Working Paper 2) and performance objectives (from Working Paper 3) for the US 60|US 70|US 191 corridor were used to determine the initial safety needs, as described in Section 2.1. The safety data used to calculate baseline performance was provided by ADOT for the timeframe from 2010 through 2014.

Step 1 uses the scores for the Safety Index primary performance measure and two of the five secondary safety performance measures to determine the initial level of need by segment for each performance measure individually as well as for all performance measures combined. The two secondary performance measures used are the Directional Safety Index and the Strategic Highway Safety Plan (SHSP) Top 5 Emphasis Area Behaviors. The three other secondary safety performance measures (Truck-Involved Crashes, Motorcycle-Involved Crashes, and Non-Motorized Crashes) exhibited small crash sample sizes in their entirety and were not considered in the Safety Performance Area needs assessment (refer to sample size criteria documented in Working Paper 2). Corridor segments that exhibited small crash sample sizes for the SHSP Top 5 Emphasis Area Behaviors were also excluded from the safety needs assessment.

The performance scores, performance objectives, and initial levels of need for each safety performance measure and for all safety performance measures combined are shown in **Table 11**.

For the Safety Index, four segments report a high level of need, one segment reports a medium level of need, and one reports a low level of need. For the secondary Directional Safety Index, in the NB/WB direction six segments report a high level of need and in the SB/EB direction five segments report a high level of need and one medium level of need. For the SHSP Top 5 Emphasis Area Behaviors, two segments report high levels of need and one reported medium. Truck-Involved Crashes, Motorcycle-Involved Crashes, and Non-Motorized Crashes were not considered in the needs assessment due to small crash sample sizes. For all safety performance measures combined, five segments report a high level of initial need and three segments report a low level of initial need.

6.2 Step 2: Final Safety Needs

Once the initial safety needs by segment for the US 60|US 70|US 191 corridor were established, they were then refined in Step 2 as described in Section 2.2 to more accurately reflect existing needs. An evaluation of crash hot spots as well as relevant recently completed and under-construction projects was performed to determine if segment need levels required adjustment. The initial needs were then refined based on this assessment to determine the final need for each segment. Planned and programmed future projects and other issues identified in previous reports were noted for future reference in developing solutions that address identified needs. The Step 2 process is described in more detail below and summarized in **Table 12**.

Safety Hot Spots

There are two segments containing a safety hot spot. The location of the safety hot spots are listed in **Table 12**. The safety hot spots are within a segment that already has an identified initial need, so no adjustments were made to the need level of the segments to account for the hot spot.

Recently Completed and Under-Construction Projects

ADOT provided information on potentially relevant recently completed and under-construction projects that were not previously reflected in the baseline performance data. This includes any projects completed or under construction after 2014 that have the potential to mitigate a safety need on a corridor segment.

There is are four segments containing recently completed projects which would supersede the safety data, as shown in **Table 12**. The recently completed projects partially addressed the identified safety needs for one of the four segments. Available crash modification factors for the reconstruction of existing two-lane undivided roadway into a four-lane divided high and reconstruction of existing three-lane roadway into a four-lane roadway with a raised median were applied to the safety performance data and a new level of needs were calculated based on the improved performance score. The segment level of need changed from High to Medium so the final need was updated accordingly.

Planned or Programmed Projects

Information was noted in **Table 12** on safety-related planned and programmed projects and other issues identified in previous reports in Working Paper 1. Planned and programmed projects and identified issues do not influence the level of need, but were documented for future reference in developing solutions that address identified needs.

Table 11: Initial Safety Needs (Step 1)

Segment	Operating Environment	Segment Length (miles)	Segment Mileposts (MP)	Safety Index			Directional Safety Index					% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors		
				Performance Score	Performance Objective	Level of Need	NB/WB Performance Score	SB/EB Performance Score	Performance Objective	NB/WB Level of Need	SB/EB Level of Need	Performance Score	Performance Objective	Level of Need
191-1	2 or 3 Lane Undivided Highway	24	0-24	0.44	Average or Better	None	0.10	0.78	Average or Better	None	None	Insufficient Data	Average or Better	N/A
191-2	2 or 3 Lane Undivided Highway	43	24-67	0.28	Average or Better	None	0.53	0.03	Average or Better	None	None	Insufficient Data	Average or Better	N/A
191-3	2 or 3 or 4 Lane Divided Highway	17	87-104	1.00	Average or Better	Low	0.00	2.00	Average or Better	None	High	Insufficient Data	Average or Better	N/A
191-4	2 or 3 Lane Undivided Highway	12	104-116	0.03	Average or Better	None	0.07	0.00	Average or Better	None	None	Insufficient Data	Average or Better	N/A
191-5	4 or 5 Lane Undivided Highway	5	116-121	1.30	Average or Better	Medium	1.34	1.25	Average or Better	High	Medium	Insufficient Data	Average or Better	N/A
70-6	4 or 5 Lane Undivided Highway	9	339-330	0.93	Average or Better	None	1.68	0.18	Average or Better	High	None	73%	Average or Better	High
70-7	2 or 3 Lane Undivided Highway	19	330-300	0.10	Average or Better	None	0.20	0.00	Average or Better	None	None	Insufficient Data	Average or Better	N/A
70-8	2 or 3 Lane Undivided Highway	2	300-298	Insufficient Data	Average or Better	N/A	Insufficient Data	Insufficient Data	Average or Better	N/A	N/A	Insufficient Data	Average or Better	N/A
70-9	2 or 3 Lane Undivided Highway	5	298-293	Insufficient Data	Average or Better	N/A	Insufficient Data	Insufficient Data	Average or Better	N/A	N/A	Insufficient Data	Average or Better	N/A
70-10	2 or 3 Lane Undivided Highway	19	293-274	1.88	Average or Better	High	1.50	2.25	Average or Better	High	High	Insufficient Data	Average or Better	N/A
70-11	2 or 3 Lane Undivided Highway	4	274-270	Insufficient Data	Average or Better	N/A	Insufficient Data	Insufficient Data	Average or Better	N/A	N/A	Insufficient Data	Average or Better	N/A
70-12	2 or 3 Lane Undivided Highway	15	270-255	1.67	Average or Better	High	1.67	1.67	Average or Better	High	High	Insufficient Data	Average or Better	N/A
70/60E-13	4 or 5 Lane Undivided Highway	12	255-243	2.09	Average or Better	High	1.64	2.55	Average or Better	High	High	56%	Average or Better	High
60E-14	2 or 3 Lane Undivided Highway	16	243-227	3.23	Average or Better	High	2.23	4.23	Average or Better	High	High	55%	Average or Better	Medium
60E-15	2 or 3 Lane Undivided Highway	2	227-225	Insufficient Data	Average or Better	N/A	Insufficient Data	Insufficient Data	Average or Better	N/A	N/A	Insufficient Data	Average or Better	N/A
60E-16	2 or 3 Lane Undivided Highway	2	225-223	Insufficient Data	Average or Better	N/A	Insufficient Data	Insufficient Data	Average or Better	N/A	N/A	Insufficient Data	Average or Better	N/A
60E-17	2 or 3 or 4 Lane Divided Highway	11	223-212	0.81	Average or Better	None	1.28	0.33	Average or Better	Medium	None	42%	Average or Better	None
Safety Emphasis Area?		**Yes**	**Corridor Weighted Average**	**1.01**	**Above Average**	**Medium**								

Table 11: Initial Safety Needs (Step 1) (continued)

Segment	Operating Environment	Segment Length (miles)	Segment Mileposts (MP)	% of Fatal + Incapacitating Injury Crashes Involving Trucks			% of Fatal + Incapacitating Injury Crashes Involving Motorcycles			% of Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers			Initial Need
				Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	
191-1	2 or 3 Lane Undivided Highway	24	0-24	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	None
191-2	2 or 3 Lane Undivided Highway	43	24-67	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	None
191-3	2 or 3 or 4 Lane Divided Highway	17	87-104	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Low
191-4	2 or 3 Lane Undivided Highway	12	104-116	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	None
191-5	4 or 5 Lane Undivided Highway	5	116-121	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	High
70-6	4 or 5 Lane Undivided Highway	9	339-330	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Low
70-7	2 or 3 Lane Undivided Highway	19	330-300	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	None
70-8	2 or 3 Lane Undivided Highway	2	300-298	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	N/A
70-9	2 or 3 Lane Undivided Highway	5	298-293	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	N/A
70-10	2 or 3 Lane Undivided Highway	19	293-274	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	High
70-11	2 or 3 Lane Undivided Highway	4	274-270	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	N/A
70-12	2 or 3 Lane Undivided Highway	15	270-255	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	High
70/60E-13	4 or 5 Lane Undivided Highway	12	255-243	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	High
60E-14	2 or 3 Lane Undivided Highway	16	243-227	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	High
60E-15	2 or 3 Lane Undivided Highway	2	227-225	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	N/A
60E-16	2 or 3 Lane Undivided Highway	2	225-223	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	N/A
60E-17	2 or 3 or 4 Lane Divided Highway	11	223-212	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Insufficient Data	Average or Better	N/A	Low

Table 12: Final Safety Needs (Step 2)

Segment	Segment Length (miles)	Segment Mileposts (MP)	Initial Need	Hot Spots	Relevant Recently Completed or Under Construction Projects (which supersede performance data)*	Final Need	Comments (may include tentatively programmed projects with potential to address need or other relevant issues identified in previous reports)
191-1	24	0-24	None	None	None	None	The segment had an initial need of none and no relevant recently completed or under construction projects were identified. No programmed or planned projects were identified in this segment.
191-2	43	24-67	None	None	None	None	The segment had an initial need of none and no relevant recently completed or under construction projects were identified. No programmed or planned projects were identified in this segment.
191-3	17	87-104	Low	None	None	Low	The segment had an initial need of low and no relevant recently completed or under construction projects were identified. No programmed or planned projects were identified in this segment.
191-4	12	104-116	None	None	None	None	The segment had an initial need of none and no relevant recently completed or under construction projects were identified. No programmed or planned projects were identified in this segment.
191-5	5	116-121	High	None	None	High	The segment had an initial need of high and no relevant recently completed or under construction projects were identified. The higher concentration of incidents can be associated with the urbanized area of Safford in addition to the limited controlled intersection. No programmed or planned projects were identified in this segment.
70-6	9	339-330	Low	None	None	Low	The segment had an initial need of low and no relevant recently completed or under construction projects were identified. Planned or programmed projects include: Safety/Intersection Improvements MP 338-339 ADOT 5 Year Program
70-7	19	330-300	None	None	None	None	The segment had an initial need of none and no relevant recently completed or under construction projects were identified. No programmed or planned projects were identified in this segment.
70-8	2	300-298	N/A	None	None	N/A	The segment did not have sufficient data to determine level of need.
70-9	5	298-293	N/A	None	None	N/A	The segment did not have sufficient data to determine level of need.
70-10	19	293-274	High	None	None	High	The segment had an initial need of high and no relevant recently completed or under construction projects were identified. The high level of initial and final need is associated with the high ratio of fatal crashes compared to those resulting in incapacitating injuries. No programmed or planned projects were identified in this segment.

Segment	Segment Length (miles)	Segment Mileposts (MP)	Initial Need	Hot Spots	Relevant Recently Completed or Under Construction Projects (which supersede performance data)*	Final Need	Comments (may include tentatively programmed projects with potential to address need or other relevant issues identified in previous reports)
70-11	4	274-270	N/A	None	None	N/A	The segment did not have sufficient data to determine level of need.
70-12	15	270-255	High	None	None	High	The segment had an initial need of high no relevant recently completed or under construction projects were identified. The high level of initial and final need is associated with the high ratio of fatal crashes compared to those resulting in incapacitating injuries. No programmed or planned projects were identified in this segment.
70/60E-13	12	255-243	High	NB/WB: MP 246-249, SB/EB: MP 246-249	None	High	The segment had an initial need of high no relevant recently completed or under construction projects were identified. The higher concentration of incidents can be associated with the urbanized areas of Globe and Miami. No programmed or planned projects were identified in this segment.
60E-14	16	243-227	High	NB/WB: MP 227-229, SB/EB: MP 232-234	**MP 228.10-228.85 (H5818):** Construct concrete barrier, installing guardrail and fence and related items	Medium	An adjustment for the final need was warranted due to the completed project which supersedes the performance data. The constructed project includes climbing/passing lane(s), which will improve safety of the corridor. It is estimated that the improvements do not address all the issues associated with the segment, therefore an estimate based on established crash reduction factors associated with the installation of climbing/passing lanes was applied. The high initial and final need can be associated with the mountainous terrain along this section of the corridor. No programmed or planned projects were identified in this segment.
60E-15	2	227-225	N/A	None	**MP 225-226.87 (H7900):** Reconstructing the existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	N/A	The segment did not have sufficient data to determine level of need.
60E-16	2	225-223	N/A	None	**MP 223-225 (H7900):** Reconstructing the existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	N/A	The segment did not have sufficient data to determine level of need.
60E-17	11	223-212	Low	None	**MP 221.72-223 (H7900):** Reconstructing the existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	None	No programmed or planned projects were identified in this segment. An adjustment for the final need was warranted based on projects completed or under construction which supersede performance data.

6.3 Step 3: Safety Contributing Factors

As described in Section 2.3, Step 3 identifies potential contributing factors to the performance needs calculated in Step 2. These contributing factors provide information on what types of improvements may help improve performance. Contributing factors can be derived from:

- Hot spot crash summaries
- Previously completed safety-related projects
- District input on safety concerns
- Segment crash type summaries
- Section 6.2 of the 2010 Highway Safety Manual

Hot Spot Crash Summaries

Crash summaries were developed for each identified crash hot spot to identify observable crash patterns. These crash summaries are based on crashes of all severity levels (not just fatal and incapacitating injury) to provide more information for use in identifying crash patterns.

Previously Completed Safety-Related Projects

Recently completed safety-related projects may provide insight into previously identified contributing factors along the corridor. Some recently completed safety-related projects may already address some of the crash patterns evident in the crash analysis. Other safety-related projects completed before the crash analysis time period (i.e., more than five years old) may have exceeded their respective design life and rehabilitation or replacement could increase their effectiveness. Examples include rumble strips that are worn down or retroreflective materials that have lost their retro reflectivity.

District Input on Safety Concerns

ADOT maintenance personnel provided information on locations where they had observed potential safety needs. Locations were defined by approximate milepost limits and assigned to the appropriate corridor segment. District safety concerns that corroborated the segment crash type summaries or crash hot spots summaries were noted.

Segment Crash Type Summaries

Crash frequencies for each possible crash type descriptor within each of the eight crash type summary categories were summarized for fatal and incapacitating injury crashes for each corridor segment that contained at least five crashes of that crash type descriptor (lower crash totals were not considered to have a sufficient sample size for analysis purposes). For an even more robust data set, crash types for crashes of all severity levels (not just fatal and incapacitating injury) can be reviewed to determine if crash patterns are readily identifiable. If this more detailed analysis is conducted, it is recommended that it only be conducted on segments with medium or high levels of need to minimize analysis effort.

The proportional occurrence of each possible crash type descriptor compared to the total number of fatal plus incapacitating injury crashes occurring in that respective segment was also calculated and expressed as a percentage. These segment-level crash type descriptor frequency percentages were then compared with the corresponding statewide crash type descriptor frequency percentages for all state highways with similar operating environments (as defined in the baseline corridor performance in Working Paper 2). Segment crash type descriptor frequency percentages that exceeded the corresponding statewide frequency percentage were identified as likely contributing factors to the level of need (illustrated with a red font). The crash type descriptors include the following components:

- **First Harmful Event Type**
  - Collision with Motor Vehicle
  - Overturning
  - Collision with Pedestrian
  - Collision with Pedalcyclist
  - Collision With Animal
  - Collision with Fixed Object
  - Collision with Non-Fixed Object
  - Vehicle Fire or Explosion
  - Other Non-Collision
  - Unknown

- **Collision Type**
  - Single Vehicle Collisions
  - Angle
  - Left Turn
  - Rear End
  - Head On
  - Sideswipe (same)
  - Sideswipe (opposite)
  - Rear to Side
  - Rear to Rear
  - Other
  - Unknown

- **Violation or Behavior Type**
  - No Improper Action
  - Speed too Fast for Conditions
  - Exceeded Lawful Speed
  - Failure to Yield Right-of-Way
  - Followed Too Closely
  - Ran Stop Sign
  - Disregarded Traffic Signal
  - Made Improper Turn
  - Drove in Opposing Lane
  - Faulty/Missing Equipment
  - Motorcycle Safety Equipment Use
  - Passed in No Passing Zone
  - Unsafe Lane Change
  - Failure to Keep in Proper Lane

  - Other Unsafe Passing
  - Inattention/Distraction
  - Electronic Communications Device
  - Other

- **Type of Lighting Conditions**
  - Daylight
  - Dawn
  - Dusk
  - Dark-Lighted
  - Dark-Unlighted
  - Dark-Unknown Lighting

- **Type of Road Surface Conditions**
  - Dry
  - Wet
  - Snow
  - Slush
  - Ice/Frost
  - Water (standing or moving)
  - Sand
  - Mud, Dirt, Gravel
  - Oil
  - Other
  - Unknown

- **First Unit Event Description**
  - Collision with Animal
  - Collision with Fixed Object
  - Ran Off the Road (Left)
  - Ran Off the Road (Right)
  - Crossed Centerline
  - Crossed Median
  - Collision with Pedestrian
  - Motor Vehicle in Transport
  - Overturn
  - Equipment Failure
  - Collision with Falling Object
  - Other Non-Collision
  - Other Non-Fixed Object
  - Unknown

- **Driver Physical Condition**
  - Under the Influence of Drugs or Alcohol
  - Fatigued/Fell Asleep
  - No Apparent Influence
  - Had Been Drinking
  - Medications
  - Illness
  - Physical Impairment
  - Other
  - Unknown

- **Safety Device Usage**
  - Shoulder and Lap Belt
  - Child Restraint System
  - None Used
  - Helmet Used
  - Air Bag Deployed/Shoulder-Lap Belt
  - Air Bag Deployed
  - Other
  - Unknown
  - Not Applicable
  - Lap Belt
  - Not Reported

Section 6.2 of the 2010 Highway Safety Manual

Section 6.2 of the 2010 Highway Safety Manual (HSM) provides potential contributing factors for corresponding crash types and patterns. Crash patterns within the corridor that match crash patterns in the HSM can reasonably be expected to have similar potential contributing factors to those listed in the HSM.

Safety Needs Contributing Factors

Likely contributing factors were developed based on the information obtained through the hot spot crash summaries, previously completed safety-related projects, District input on safety concerns, segment crash type summaries, and HSM potential contributing factors. These contributing factors provide guidance on the types of solutions that will likely promote improved safety performance. **Table 13** summarizes the likely contributing factors to safety needs on the US 60|US 70|US 191.

Table 13: Safety Needs Contributing Factors (Step 3)

		191-1	191-2	191-3	191-4	191-5	70-6
Segment Number							
Segment Length (miles)		24	43	17	12	5	9
Segment Milepost (MP)		0-24	24-67	87-104	104-116	116-121	339-330
Final Need		None	None	Low	None	High	Low
Segment Crash Overview		1 Crashes were fatal 3 Crashes had incapacitating injuries 0 Crashes involve trucks 0 Crashes involve Motorcycles	1 Crashes were fatal 2 Crashes had incapacitating injuries 0 Crashes involve trucks 1 Crashes involve Motorcycles	2 Crashes were fatal 0 Crashes had incapacitating injuries 0 Crashes involve trucks 0 Crashes involve Motorcycles	0 Crashes were fatal 1 Crashes had incapacitating injuries 0 Crashes involve trucks 1 Crashes involve Motorcycles	2 Crashes were fatal 3 Crashes had incapacitating injuries 0 Crashes involve trucks 1 Crashes involve Motorcycles	2 Crashes were fatal 8 Crashes had incapacitating injuries 0 Crashes involve trucks 0 Crashes involve Motorcycles
Segment Crash Summaries (Fatal and Serious Injury Crashes)	**First Harmful Event Type**	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	60% Involve Collision with Motor Vehicle 40% Involve Collision with Pedestrian 0% Involve Overturning	100% Involve Collision with Motor Vehicle 0% Involve Overturning 0% Involve Collision with Pedestrian
	Collision Type	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	40% Involve Left Turn 40% Involve Other 20% Involve Angle	50% Involve Rear End 30% Involve Angle 20% Involve Left Turn
	Violation or Behavior	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	40% Involve Failure to Yield Right-of-Way 20% Involve No Improper Action 20% Involve Did Not Use Crosswalk	30% Involve Disregarded Traffic Signal 30% Inattention/Distraction 10% Involve No Improper Action
	Lighting Conditions	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	40% Occur in Dark-Lighted Conditions 40% Occur in Dark-Unlighted 20% Occur in Daylight Conditions	80% Occur in Daylight Conditions 10% Occur in Dark-Lighted Conditions 10% Occur in Dark-Unlighted
	Surface Conditions	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	100% Involve Dry Conditions 0% Involve Wet Conditions 0% Involve Other	100% Involve Dry Conditions 0% Involve Wet Conditions 0% Involve Other
	First Unit Event	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	100% Involve a first unit event of Motor Vehicle in Transport 0% Involve a first unit event of Crossed Centerline 0% Involve a first unit event of Ran Off the Road (Right)	100% Involve a first unit event of Motor Vehicle in Transport 0% Involve a first unit event of Crossed Centerline 0% Involve a first unit event of Ran Off the Road (Right)
	Driver Physical Condition	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	60% Under the Influence of Drugs or Alcohol 20% No Apparent Influence 20% Unknown	30% No Apparent Influence 30% Unknown 20% Under the Influence of Drugs or Alcohol
	Safety Device Usage	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	40% Not Applicable 20% Shoulder And Lap Belt Used 20% Not Reported	40% Shoulder And Lap Belt Used 40% None Used 10% Air Bag Deployed/Shoulder-Lap Belt
Hot Spot Crash Summaries		No identified hot spot	No identified hot spot	No identified hot spot	No identified hot spot	No identified hot spot	No identified hot spot
Previously Completed Safety-Related Projects		None	None	None	None	None	None
District Interviews/Discussions							
Contributing Factors		N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	- Pavement surface conditions - Shoulder/ rumble stripe conditions - Traffic control device reflectivity - Lighting - High traffic volumes - Crosswalk visibility	- Traffic control device reflectivity - Intersection geometry - High traffic volumes

Table 13: Safety Needs Contributing Factors (Step 3) (continued)

		70-7	70-8	70-9	70-10	70-11	70-12
Segment Number		**70-7**	**70-8**	**70-9**	**70-10**	**70-11**	**70-12**
Segment Length (miles)		**19**	**2**	**5**	**19**	**4**	**15**
Segment Milepost (MP)		**330-300**	**300-298**	**298-293**	**293-274**	**274-270**	**270-255**
Final Need		None	N/A	N/A	High	N/A	High
Segment Crash Overview		0 Crashes were fatal 4 Crashes had incapacitating injuries 1 Crashes involve trucks 0 Crashes involve Motorcycles	0 Crashes were fatal 0 Crashes had incapacitating injuries 0 Crashes involve trucks 0 Crashes involve Motorcycles	1 Crashes were fatal 0 Crashes had incapacitating injuries 0 Crashes involve trucks 0 Crashes involve Motorcycles	5 Crashes were fatal 0 Crashes had incapacitating injuries 0 Crashes involve trucks 0 Crashes involve Motorcycles	1 Crashes were fatal 0 Crashes had incapacitating injuries 0 Crashes involve trucks 0 Crashes involve Motorcycles	4 Crashes were fatal 0 Crashes had incapacitating injuries 1 Crashes involve trucks 0 Crashes involve Motorcycles
Segment Crash Summaries (Fatal and Serious Injury Crashes)	**First Harmful Event Type**	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	40% Involve Collision with Motor Vehicle 40% Involve Overturning 20% Involve Unknown	N/A - Sample size too small	N/A - Sample size too small
	Collision Type	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	60% Involve Single Vehicle 20% Involve Head On 20% Involve Other	N/A - Sample size too small	N/A - Sample size too small
	Violation or Behavior	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	60% Involve Unknown 20% Involve Drove in Opposing Lane 20% Inattention/Distraction	N/A - Sample size too small	N/A - Sample size too small
	Lighting Conditions	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	40% Occur in Dark-Unlighted Conditions 40% Occur in Dark-Unknown Lighting 20% Occur in Daylight Conditions	N/A - Sample size too small	N/A - Sample size too small
	Surface Conditions	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	60% Involve Dry Conditions 40% Involve Unknown Conditions 0% Involve Wet Conditions	N/A - Sample size too small	N/A - Sample size too small
	First Unit Event	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	20% Involve a first unit event of Ran Off the Road (Right) 20% Involve a first unit event of Crossed Centerline 20% Involve a first unit event of Overturn	N/A - Sample size too small	N/A - Sample size too small
	Driver Physical Condition	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	60% Unknown 20% Under the Influence of Drugs or Alcohol 20% No Apparent Influence	N/A - Sample size too small	N/A - Sample size too small
	Safety Device Usage	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	60% Unknown 20% Shoulder And Lap Belt Used 20% None Used	N/A - Sample size too small	N/A - Sample size too small
Hot Spot Crash Summaries		No identified hot spot	No identified hot spot	No identified hot spot	No identified hot spot	No identified hot spot	No identified hot spot
Previously Completed Safety-Related Projects		None	None	None	None	None	None
District Interviews/Discussions							
Contributing Factors		N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	- Shoulder/ rumble stripe conditions - Traffic control device reflectivity - Clear zone slope and obstructions - High traffic volumes - Driver physical conditions - Shoulder width - Intersection geometry	N/A - Sample size too small	N/A - Sample size too small

Table 13: Safety Needs Contributing Factors (Step 3) (continued)

Segment Number		**70/60E-13**		**60E-14**		**60E-15**		**60E-16**		**60E-17**		**Corridor-Wide Crash Characteristics**			
Segment Length (miles)		**12**		**16**		**2**		**2**		**11**					
Segment Milepost (MP)		**255-243**		**243-227**		**227-225**		**225-223**		**223-212**					
Final Need		High		Medium		N/A		N/A		None					
Segment Crash Overview		8	Crashes were fatal	9	Crashes were fatal	1	Crashes were fatal	0	Crashes were fatal	2	Crashes were fatal	39	Crashes were fatal		
		27	Crashes had incapacitating injuries	20	Crashes had incapacitating injuries	3	Crashes had incapacitating injuries	1	Crashes had incapacitating injuries	10	Crashes had incapacitating injuries	82	Crashes had incapacitating injuries		
		0	Crashes involve trucks	1	Crashes involve trucks	1	Crashes involve trucks	0	Crashes involve trucks	0	Crashes involve trucks	4	Crashes involve trucks		
		3	Crashes involve Motorcycles	9	Crashes involve Motorcycles	0	Crashes involve Motorcycles	0	Crashes involve Motorcycles	3	Crashes involve Motorcycles	18	Crashes involve Motorcycles		
Segment Crash Summaries (Fatal and Serious Injury Crashes)	**First Harmful Event Type**	66%	Involve Collision with Motor Vehicle	38%	Involve Collision with Fixed Object	N/A - Sample size too small		N/A - Sample size too small		50%	Involve Collision with Motor Vehicle	52%	Involve Collision with Motor Vehicle		
		11%	Involve Collision with Fixed Object	31%	Involve Collision with Motor Vehicle					25%	Involve Overturning	15%	Involve Collision with Fixed Object		
		9%	Involve Collision with Pedestrian	14%	Involve Overturning					17%	Involve Collision with Fixed Object	13%	Involve Overturning		
	Collision Type	29%	Involve Rear End	66%	Involve Single Vehicle	N/A - Sample size too small		N/A - Sample size too small		50%	Involve Single Vehicle	36%	Involve Single Vehicle		
		23%	Involve Single Vehicle	14%	Involve Head On					17%	Involve Angle	18%	Involve Rear End		
		17%	Involve Angle	7%	Involve Angle					17%	Involve Rear End	13%	Involve Angle		
	Violation or Behavior	26%	Involve Failure to Yield Right-of-Way	38%	Involve Speed too Fast for Conditions	N/A - Sample size too small		N/A - Sample size too small		42%	Involve Speed too Fast for Conditions	22%	Involve Speed too Fast for Conditions		
		20%	Involve Inattention/Distraction	17%	Involve No Improper Action					25%	Involve Unknown	17%	Involve Inattention/Distraction		
		17%	Involve Speed too Fast for Conditions	14%	Involve Inattention/Distraction					17%	Involve Failure to Keep in Proper Lane	12%	Involve Unknown		
	Lighting Conditions	63%	Occur in Daylight Conditions	69%	Occur in Daylight Conditions	N/A - Sample size too small		N/A - Sample size too small		67%	Occur in Daylight Conditions	58%	Occur in Daylight Conditions		
		23%	Occur in Dark-Lighted Conditions	24%	Occur in Dark-Unlighted Conditions					33%	Occur in Dark-Unlighted Conditions	22%	Occur in Dark-Unlighted Conditions		
		6%	Occur in Dusk Conditions	3%	Occur in Dark-Lighted Conditions					0%	Occur in Dawn Conditions	12%	Occur in Dark-Lighted Conditions		
	Surface Conditions	94%	Involve Dry Conditions	76%	Involve Dry Conditions	N/A - Sample size too small		N/A - Sample size too small		100%	Involve Dry Conditions	87%	Involve Dry Conditions		
		3%	Involve Wet Conditions	7%	Involve Wet Conditions					0%	Involve Wet Conditions	7%	Involve Unknown Conditions		
		3%	Involve Unknown	7%	Involve Slush					0%	Other	3%	Involve Wet Conditions		
	First Unit Event	74%	Involve a first unit event of Motor Vehicle in Transport	45%	Involve a first unit event of Ran Off the Road (Right)	N/A - Sample size too small		N/A - Sample size too small		50%	Involve a first unit event of Motor Vehicle in Transport	47%	Involve a first unit event of Motor Vehicle in Transport		
		9%	Involve a first unit event of Ran Off the Road (Right)	28%	Involve a first unit event of Crossed Centerline					33%	Involve a first unit event of Ran Off the Road (Right)	21%	Involve a first unit event of Ran Off the Road (Right)		
		9%	Involve a first unit event of Other Non-Collision	10%	Involve a first unit event of Motor Vehicle in Transport					17%	Involve a first unit event of Ran Off the Road (Left)	16%	Involve a first unit event of Crossed Centerline		
	Driver Physical Condition	66%	No Apparent Influence	45%	No Apparent Influence	N/A - Sample size too small		N/A - Sample size too small		42%	No Apparent Influence	43%	No Apparent Influence		
		14%	Under the Influence of Drugs or Alcohol	28%	Unknown					42%	Unknown	31%	Unknown		
		14%	Unknown	24%	Under the Influence of Drugs or Alcohol					8%	Under the Influence of Drugs or Alcohol	19%	Under the Influence of Drugs or Alcohol		
	Safety Device Usage	46%	Shoulder And Lap Belt Used	48%	Shoulder And Lap Belt Used	N/A - Sample size too small		N/A - Sample size too small		33%	None Used	36%	Shoulder And Lap Belt Used		
		29%	None Used	31%	None Used					25%	Shoulder And Lap Belt Used	31%	None Used		
		11%	Unknown	14%	Helmet Used					17%	Helmet Used	11%	Unknown		
Hot Spot Crash Summaries		NB/WB: MP 246-249, SB/EB: MP 246-249		NB/WB: MP 227-229, SB/EB: MP 232-2343		No identified hot spot		No identified hot spot		No identified hot spot					
Previously Completed Safety-Related Projects		None		MP 228.10-228.85(H5818): Construct concrete barrier, installing guardrail and fence and related items		None		None		None					
District Interviews/Discussions															
Contributing Factors		- Shoulder/ rumble stripe conditions - Speed too fast for the conditions - Clear zone slope and obstructions - High traffic volumes - Shoulder width		- Pavement surface conditions - Shoulder/ rumble stripe conditions - Speed too fast for the conditions - Clear zone slope and obstructions - Driver physical conditions - Intersection geometry - Crossover crashes		N/A - Sample size too small		N/A - Sample size too small		-Shoulder/ rumble stripe conditions - Speed too fast for the conditions - High traffic volumes - Safety device usage - Shoulder width - Crossover crashes		- Pavement surface conditions - Shoulder/ rumble stripe conditions - Shoulder width - Clear zone slope and obstructions			

7.0 FREIGHT PERFORMANCE NEEDS (STEPS 1-3)

The following sections describe Steps 1 through 3 of the Needs Assessment process for the US 60|US 70|US 191 corridor for the Freight Performance Area. The methodology for performing Steps 1 through 3 is provided in **Appendix A**.

7.1 Step 1: Initial Freight Needs

The baseline performance scores (from Working Paper 2) and performance objectives (from Working Paper 3) for the US 60|US 70|US 191 corridor were used to determine the initial freight needs, as described in Section 2.1. The freight data used to calculate baseline performance was provided by ADOT for 2014 for the existing travel time data, 2010-2014 for the closure data, and 2014 for bridge clearance data.

Step 1 uses the scores for the Freight Index primary performance measure and four secondary performance measures to determine the initial level of need by segment for each performance measure individually as well as for all performance measures combined. The four secondary performance measures are Directional Truck Travel Time Index (TTTI), Directional Truck Planning Time Index (TPTI), Directional Closure Duration, and Bridge Vertical Clearance.

The performance scores, performance objectives, and initial levels of need for each freight performance measure and for all freight performance measures combined are shown in **Table 14**.

For the Freight Index, six segments report a high level of need and one segment report a medium level of need. For Directional TTTI, two segments have a medium level of need in the NB/WB direction, while in the SB/EB direction two segments have a high level of need and three have a low level of need. For Directional TPTI, in the NB/WB direction five segments report a high level of need and one a low level of need, while in the SB/EB direction six report a high level of need and one a medium level of need. For Directional Closure Duration, two segments have a medium level of need in the NB/WB direction, while in the SB/EB direction and two segments have a high level of need and one with a medium level of need. For Bridge Vertical Clearance, one segment reports a medium level of need. For all freight performance measures combined, seven segments report a high level of initial need and one a low level of need.

7.2 Step 2: Final Freight Needs

Once the initial freight needs by segment for the US 60|US 70|US 191 corridor were established, they were then refined in Step 2 as described in Section 2.2 to more accurately reflect existing needs. An evaluation of vertical clearance hot spots as well as relevant recently completed and under-construction projects was performed to determine if segment need levels required adjustment. The initial needs were then refined based on this assessment to determine the final need for each segment. Planned and programmed future projects and other issues identified in previous reports were noted for future reference in developing solutions that address identified needs. The Step 2 process is described in more detail below and summarized in **Table 15**.

Vertical Clearance Hot Spots

There are two segments containing vertical clearance hot spots, which are bridges or tunnels that provide less than 16.25 feet of vertical clearance above the corridor mainline through lanes and that cannot be ramped around. The locations of vertical clearance hot spots are listed in **Table 15**. As the vertical clearance hot spots are within segments reporting high levels of need, no adjustments were made to the need level of any segments to account for hot spots.

Recently Completed and Under-Construction Freight Projects

ADOT provided information on potentially relevant recently completed and under-construction projects that were not previously reflected in the baseline performance data. This includes any projects completed or under construction after 2014 that have the potential to mitigate a freight need on a corridor segment.

There are five segments containing a recently completed project which supersede the freight condition data, as shown in **Table 15**. The anticipated improvement in the TTTI and TPTI performance score for three of the five segments due to the addition of climbing/passing lanes, reconstructing the existing two-lane undivided roadway into a four-lane divided highway, and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median was estimated and a new level of need calculated based on the improved performance score. The segments level of need remained was affected, so adjustments were made to the need level of those segments to account for the recently completed project.

Planned or Programmed Projects

Information was noted in **Table 15** on freight-related planned and programmed projects and other issues identified in previous reports in Working Paper 1. Planned and programmed projects and identified issues do not influence the level of need, but were documented for future reference in developing solutions that address identified needs.

Table 14: Initial Freight Needs (Step 1)

Segment	Facility Operations	Segment Mileposts (MP)	Segment Length (miles)	Freight Index			Directional TTI (trucks only)					Directional PTI (trucks only)				
				Performance Score	Performance Objective	Level of Need	Performance Score		Performance Objective	Level of Need		Performance Score		Performance Objective	Level of Need	
							NB/WB	SB/EB		NB/WB	SB/EB	NB/WB	SB/EB		NB/WB	SB/EB
191-1	Interrupted	0-24	24	0.10	Fair or Better	High	1.94	1.60	Fair or Better	Medium	Low	9.11	11.62	Fair or Better	High	High
191-2	Interrupted	24-67	43	0.09	Fair or Better	High	1.00	1.54	Fair or Better	None	Low	2.68	19.67	Fair or Better	None	High
191-3	Uninterrupted	87-104	17	0.08	Fair or Better	High	1.34	1.82	Fair or Better	Medium	High	8.92	17.43	Fair or Better	High	High
191-4	Uninterrupted	104-116	12	Insufficient Data	Fair or Better	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A
191-5	Interrupted	116-121	5	Insufficient Data	Fair or Better	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A
70-6	Interrupted	339-330	9	Insufficient Data	Fair or Better	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A
70-7	Uninterrupted	330-300	19	Insufficient Data	Fair or Better	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A
70-8	Uninterrupted	300-298	2	Insufficient Data	Fair or Better	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A
70-9	Uninterrupted	298-293	5	Insufficient Data	Fair or Better	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A
70-10	Uninterrupted	293-274	19	Insufficient Data	Fair or Better	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A
70-11	Uninterrupted	274-270	4	Insufficient Data	Fair or Better	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A	Insufficient Data	Insufficient Data	Fair or Better	N/A	N/A
70-12	Uninterrupted	270-255	15	Insufficient Data	Fair or Better	N/A	Insufficient Data	1.14	Fair or Better	N/A	None	Insufficient Data	2.01	Fair or Better	N/A	High
70/60E-13	Interrupted	255-243	12	0.19	Fair or Better	Medium	1.24	1.48	Fair or Better	None	None	4.29	6.19	Fair or Better	Low	Medium
60E-14	Uninterrupted	243-227	16	0.43	Fair or Better	High	1.18	1.60	Fair or Better	None	High	2.34	2.36	Fair or Better	High	High
60E-15	Uninterrupted	227-225	2	0.33	Fair or Better	High	1.13	1.25	Fair or Better	None	Low	1.87	4.23	Fair or Better	High	High
60E-16	Uninterrupted	225-223	2	0.49	Fair or Better	High	1.14	1.00	Fair or Better	None	None	2.98	1.12	Fair or Better	High	None
60E-17	Interrupted	223-212	11	0.72	Fair or Better	None	1.07	1.14	Fair or Better	None	None	1.23	1.54	Fair or Better	None	None
Freight Emphasis Area?	**Yes**	**Corridor Weighted Average**		**0.52**	**Good**	**Low**										

Table 14: Initial Freight Needs (Step 1) (continued)

Segment	Facility Operations	Segment Mileposts (MP)	Segment Length (miles)	Closure Duration (minutes/mile/year)					Bridge Clearance (feet)			Initial Need
				Performance Score		Performance Objective	Level of Need		Performance Score	Performance Objective	Level of Need	
				NB/WB	SB/EB		NB/WB	SB/EB				
191-1	Interrupted	0-24	24	6.78	0.61	Fair or Better	None	None	No UP	Fair or Better	None	High
191-2	Interrupted	24-67	43	2.41	0.70	Fair or Better	None	None	22.04	Fair or Better	None	High
191-3	Uninterrupted	87-104	17	2.94	0.00	Fair or Better	None	None	No UP	Fair or Better	None	High
191-4	Uninterrupted	104-116	12	3.37	4.02	Fair or Better	None	None	No UP	Fair or Better	None	N/A
191-5	Interrupted	116-121	5	26.32	40.04	Fair or Better	None	None	No Bridges	Fair or Better	None	N/A
70-6	Interrupted	339-330	9	3.96	16.64	Fair or Better	None	None	No UP	Fair or Better	None	N/A
70-7	Uninterrupted	330-300	19	2.42	0.00	Fair or Better	None	None	17.03	Fair or Better	None	N/A
70-8	Uninterrupted	300-298	2	0.00	22.10	Fair or Better	None	None	No UP	Fair or Better	None	N/A
70-9	Uninterrupted	298-293	5	0.00	15.52	Fair or Better	None	None	No Bridges	Fair or Better	None	N/A
70-10	Uninterrupted	293-274	19	21.73	25.56	Fair or Better	None	None	No UP	Fair or Better	None	N/A
70-11	Uninterrupted	274-270	4	27.45	0.00	Fair or Better	None	None	No UP	Fair or Better	None	N/A
70-12	Uninterrupted	270-255	15	7.71	127.15	Fair or Better	None	Medium	No UP	Fair or Better	None	Low
70/60E-13	Interrupted	255-243	12	0.00	19.07	Fair or Better	None	None	15.84	Fair or Better	Medium	High
60E-14	Uninterrupted	243-227	16	68.54	378.72	Fair or Better	None	High	No Bridges	Fair or Better	None	High
60E-15	Uninterrupted	227-225	2	107.46	249.09	Fair or Better	Medium	High	16.79	Fair or Better	None	High
60E-16	Uninterrupted	225-223	2	108.80	0.00	Fair or Better	Medium	None	No UP	Fair or Better	None	High
60E-17	Interrupted	223-212	11	13.65	19.62	Fair or Better	None	None	No UP	Fair or Better	None	None

Table 15: Final Freight Needs (Step 2)

Segment	Segment Length (miles)	Segment Mileposts (MP)	Initial Need	Vertical Clearance Hot Spots (Vertical Clearance < 16.25' and No Ramps)	Relevant Recently Completed or Under Construction Projects (which supersede performance data)*	Final Need	Comments (may include tentatively programmed projects with potential to address needs or other relevant issues identified in previous reports)
191-1	24	0-24	High	None	None	High	DMS NB/SB MP 2
191-2	43	24-67	High	None	Paving project completed, Cochise TI currently in design.	High	Reconstruct I-10 Interchange MP 67.5
191-3	17	87-104	High	None	None	High	I-10 to US 70 Reconstruct to 4 lane divided MP 87-104*; DMS SB MP 90
191-4	12	104-116	N/A	None	None	N/A	I-10 to US 70 Reconstruct to 4 lane divided MP 104-116*; US 191 alternate route MP 104-116; Restripe to 5 lanes MP 110.9-116; Pavement preservation MP 114-116
191-5	5	116-121	N/A	None	None	N/A	I-10 to US 70 Reconstruct to 4 lane divided MP 116-121*; US 191 alternate route MP 116-121; Restripe to 5 lanes MP 116-118/120-121; Pavement preservation MP 116-118; DMS NB MP 116; Extend US 191 north to 8th Street MP 121
70-6	9	339-330	N/A	None	None	N/A	Widen roadway MP 330-339*; Intersection Improvement MP 337-339
70-7	19	330-300	N/A	None	None	N/A	Widen roadway MP 300-330*; Add center turn lane MP 312.25
70-8	2	300-298	N/A	None	None	N/A	Widen roadway MP 298-300*
70-9	5	298-293	N/A	None	None	N/A	Widen roadway MP 293-298*; Continuous two-way left turn lane MP 294-298; Eliminate passing zone MP 296.5-297.7; Eliminate passing zone MP 294.6-295.5
70-10	19	293-274	N/A	None	None	N/A	Widen roadway MP 274-293*; Climbing lane MP 282-288
70-11	4	274-270	N/A	None	None	N/A	Widen roadway MP 270-274*; Construct passing lane MP 270-271
70-12	15	270-255	Low	None	None	Low	Widen roadway MP 255-270*; Passing lane MP 267-270; Climbing lane MP 262-264
70/60E-13	12	255-243	High	1 (Pinal SPRR UP - MP 253.63, #0562)	None	High	Widen roadway MP 253-255*; Widen to four lane MP 243-254; DMS EB MP 253; Paved Shoulder MP 243-252; DMS EB MP 247; Access management MP 243-245.5; Turn lanes MP 244.5; Restripe to five lane MP 244-244.25
60E-14	16	243-227	High	1 (Queen Creek Tunnel)	**MP 229.48-241.93 (H5818):** Construct climbing and passing lanes	Medium	Widen to four lane MP 235.5-243; Paved Shoulder MP 227-243; Shoulder improvements EB/WB MP 227-242. An adjustment for the Final Need was warranted based on projects completed or under construction which supersede performance data
60E-15	2	227-225	High	None	**MP 225-226.87 (H7900):** Reconstructing existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	Low	An adjustment for the Final Need was warranted based on projects completed or under construction which supersede performance data
60E-16	2	225-223	High	None	**MP 223-225 (H7900):** Reconstructing existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	Low	An adjustment for the Final Need was warranted based on projects completed or under construction which supersede performance data
60E-17	11	223-212	None	None	**MP 221.72-223 (H7900):** Reconstructing existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	None	Construct new EB lanes MP 219.9-222.3; Construct new WB lanes MP 216.3-219.9; New Queen Valley TI MP 215-214

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7.3 Step 3: Freight Contributing Factors

As described in Section 2.3, Step 3 identifies potential contributing factors to the performance needs calculated in Step 2. These contributing factors provide information on what types of improvements may help improve performance. Contributing factors include:

- Roadway variables
- Traffic variables
- Relevant freight-related existing infrastructure
- Closure type
- Non-actionable conditions

Roadway Variables

Roadway variables include functional classification, environmental type (e.g., urban, rural), terrain, number of lanes, speed limit, presence of auxiliary lanes, if a roadway is divided or non-divided, and how often passing is not allowed. These variables are described in more detail below:

- Functional classification indicates if a roadway is an interstate, state highway, or arterial. Capacity equations and parameters differ depending on a roadway's functional classification.
- Environmental type refers to how developed the land is adjacent to the roadway. Environmental types include urban, fringe urban, and rural. Capacity thresholds differ depending on the environmental type as higher congestion levels are more acceptable in urbanized areas than in rural areas.
- Terrain (described as level, rolling, or mountainous) indicates the general roadway grade, which influences how quickly vehicles can accelerate or decelerate or maintain a constant speed.
- The number of lanes in each direction indicates how many general purpose through lanes exist.
- The speed limit indicates the posted speed limit.
- The presence of auxiliary lanes for turning, weaving, or passing can improve mobility performance by maintaining more consistent speeds in mainline through lanes.
- A roadway is considered divided if it has a raised or depressed median separating the directions of traffic that cannot easily be traversed. A roadway with a painted paved median is considered a non-divided roadway. Dividing a roadway generally increases the roadway capacity.
- The presence of no-passing zones restricts the movement of vehicles around slower-moving vehicles.

Traffic Variables

Traffic variables include existing and future level of service (LOS), percent (%) trucks, and the buffer index (difference between PTI and TTI). The existing and future LOS, percentage of trucks, and buffer index can indicate how well a corridor is performing in terms of overall mobility and why certain segments of a corridor may be performing worse than others.

Existing and Future LOS

The existing and future LOS provide a letter "grade" between "A" and "F" for mobility that is generally reflective of Existing and Future V/C calculations. LOS values of "A", "B", and "C" are generally considered highly acceptable. A LOS value of "D" is generally considered moderately acceptable. LOS values of "E" and "F" are generally considered unacceptable.

Truck Traffic

The amount of truck traffic in a given segment of the corridor can be represented as a percentage of the overall total traffic volume for that specific segment. The truck volume on a corridor can impact overall mobility based on truck travel speed, corridor grades, required inspection points and number of lanes.

Buffer Index

The Buffer Index is calculated by subtracting the segment level TTI value (ratio of peak hour speed to free flow speed) from the segment level PTI value (95th percentile speed). The TTI and PTI values were determined in Working Paper 2. The buffer index expresses the amount of extra time necessary to be on-time 95 percent of the time for any given trip. This calculation provides information on the reliability of a corridor.

Freight-Related Infrastructure

Freight related infrastructure refers to devices or features at specific locations that influence freight performance. Examples include DMS, passing lanes, climbing lanes, POE, weigh stations, rest areas, and parking areas.

Closure Type

The relative frequency of types of closures within each segment helps indicate potential causes of freight-related needs. Closure types consist of closures due to an incident/crash, obstruction, or weather condition. The number of each type of closure and the corresponding percentage of all closures that are of each type are noted.

Non-Actionable Conditions

Non-actionable conditions are features or characteristics that result in poor freight performance that cannot be addressed through an engineered solution. Examples include border patrol checkpoints that require all vehicles to slow down or stop for inspection.

Freight Needs Contributing Factors

Table 16 summarizes the potential contributing factors to freight needs on the US 60|US 70|US 191 corridor.

Table 16: Freight Needs Contributing Factors (Step 3)

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Roadway Variables								Traffic Variables					Relevant Freight Related Existing Infrastructure
				Functional Classification	Environmental Type (Urban/Rural)	Terrain	# of Lanes/ Direction	Speed Limit	Aux Lanes	Divided/ Non-Divided	% No Passing	Existing LOS	Future 2035 LOS	% Trucks	NB Buffer Index (TPTI-TTTI)	SB Buffer Index (TPTI-TTTI)	
191-1	0-24	24	High	State Highway	Rural	Level	2	55	No	Non-Divided	12%	A-C	A-C	17%	7.17	10.02	Rest Area MP 0; Weigh-In-Motion MP 0.5
191-2	24-67	43	High	State Highway	Rural	Level	2	55	No	Non-Divided	26%	A-C	A-C	17%	1.68	18.13	Border Patrol Check Point MP 43
191-3	87-104	17	High	State Highway	Rural	Level	4	55	No	Divided	3%	A-C	A-C	17%	7.58	15.61	None
191-4	104-116	12	N/A	State Highway	Fringe Urban	Level	4	65	No	Non-Divided	30%	A-C	A-C	17%	N/A	N/A	None
191-5	116-121	5	N/A	State Highway	Urban	Level	4	40	No	Non-Divided	13%	A-C	A-C	17%	N/A	N/A	None
70-6	339-330	9	N/A	State Highway	Urban	Level	4	40	No	Non-Divided	0%	A-C	A-C	5%	N/A	N/A	Rest Area MP 339; Permanent Traffic Counter MP 337
70-7	330-300	19	N/A	State Highway	Rural	Level	2	55	No	Non-Divided	13%	A-C	A-C	5%	N/A	N/A	None
70-8	300-298	2	N/A	State Highway	Rural	Level	2	65	No	Non-Divided	6%	A-C	A-C	5%	N/A	N/A	None
70-9	298-293	5	N/A	State Highway	Fringe Urban	Level	2	50	No	Non-Divided	53%	A-C	A-C	5%	N/A	N/A	Rest Area MP 296
70-10	293-274	19	N/A	State Highway	Rural	Level	2	55	No	Non-Divided	37%	A-C	A-C	5%	N/A	N/A	None
70-11	274-270	4	N/A	State Highway	Fringe Urban	Level	2	55	No	Non-Divided	77%	A-C	A-C	5%	N/A	N/A	None
70-12	270-255	15	Low	State Highway	Rural	Level	2	60	No	Non-Divided	10%	A-C	A-C	11%	N/A	0.87	Passing Lane MP 263
70/60E-13	255-243	12	High	State Highway	Urban	Level	4	45	No	Non-Divided	0%	A-C	A-C	12%	3.05	4.71	CCTV MP 254; Permanent Traffic Counter MP 252
60E-14	243-227	16	Medium	State Highway	Rural	Mountainous	2	50	No	Non-Divided	68%	E/F	E/F	14%	1.16	0.76	Climbing Lane MP 241-236/ 234-233/ 231-228
60E-15	227-225	2	Low	State Highway	Urban	Rolling	2	45	No	Non-Divided	98%	A-C	A-C	14%	0.74	2.98	Rest Area MP 226
60E-16	225-223	2	Low	State Highway	Rural	Level	2	55	No	Non-Divided	55%	A-C	D	14%	1.84	0.12	None
60E-17	223-212	11	None	State Highway	Rural	Level	4	65	No	Divided	11%	A-C	A-C	13%	0.16	0.40	None

Table 16: Freight Needs Contributing Factors (Step 3) (continued)

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Closure Extent							Non-Actionable Conditions	Programmed and Planned Projects or Issues from Previous Documents Relevant to Final Need	Contributing Factors
				Total Number of Closures	# Incidents/ Accidents	% Incidents/ Accidents	# Obstructions/ Hazards	% Obstructions/ Hazards	# Weather Related	% Weather Related			
191-1	0-24	24	High	3	3	100%	0	0%	0	0%	WIM/Inspection Station MP 0.5	No projects identified	- Percent of closures due to Incidents/Accidents above statewide average
191-2	24-67	43	High	5	3	60%	2	40%	0	0%	Border Patrol Check Point MP 43 NB	No projects identified	- Percent of closures due to Obstructions/Hazards above statewide average
191-3	87-104	17	High	1	1	100%	0	0%	0	0%	None	No projects identified	- Percent of closures due to Incidents/Accidents above statewide average
191-4	104-116	12	N/A	4	4	100%	0	0%	0	0%	None	US 191 alternate route MP 104-116; Restripe to 5 lanes MP 110.9-116; Pavement preservation MP 114-116	- Percent of closures due to Incidents/Accidents above statewide average
191-5	116-121	5	N/A	5	5	100%	0	0%	0	0%	None	US 191 alternate route MP 116-121; Restripe to 5 lanes MP 116-118/120-121; Pavement preservation MP 116-118; DMS NB MP 116; Extend US 191 north to 8th Street MP 121	- Percent of closures due to Incidents/Accidents above statewide average
70-6	339-330	9	N/A	2	2	100%	0	0%	0	0%	None	Intersection Improvement MP 338-339	- Percent of closures due to Incidents/Accidents above statewide average
70-7	330-300	19	N/A	3	3	100%	0	0%	0	0%	None	Add center turn lane MP 312.25	- Percent of closures due to Incidents/Accidents above statewide average
70-8	300-298	2	N/A	1	0	0%	1	100%	0	0%	None	Bridge Replacement and Rehabilitation MP 299	- Percent of closures due to Obstructions/Hazards above statewide average
70-9	298-293	5	N/A	1	1	100%	0	0%	0	0%	None	Continuous two-way left turn lane MP 294-298; Eliminate passing zone MP 296.5-297.7; Eliminate passing zone MP 294.6-295.5	- Percent of closures due to Incidents/Accidents above statewide average
70-10	293-274	19	N/A	6	6	100%	0	0%	0	0%	None	Climbing lane MP 282-288	- Percent of closures due to Incidents/Accidents above statewide average
70-11	274-270	4	N/A	2	2	100%	0	0%	0	0%	None	Construct passing lane MP 270-271	- Percent of closures due to Incidents/Accidents above statewide average
70-12	270-255	15	Low	7	7	100%	0	0%	0	0%	None	Construct passing lane MP 267-270; Climbing lane MP 262-264	- Percent of closures due to Incidents/Accidents above statewide average

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Closure Extent							Non-Actionable Conditions	Programmed and Planned Projects or Issues from Previous Documents Relevant to Final Need	Contributing Factors
				Total Number of Closures	# Incidents/ Accidents	% Incidents/ Accidents	# Obstructions/ Hazards	% Obstructions/ Hazards	# Weather Related	% Weather Related			
70/60E-13	255-243	12	High	3	2	67%	1	33%	0	0%	None	Widen to four lane MP 243-254; DMS EB MP 253; Paved Should MP 243-252; DMS EB MP 247; Access management MP 243-245.5; Turn lanes MP 244.5; Restripe to five lane MP 244-244.25	- Percent of closures due to Obstructions/Hazards above statewide average
60E-14	243-227	16	Medium	47	39	83%	4	9%	4	9%	None	Widen to four lane MP 235.5-243; Paved Should MP 227-243; Shoulder improvements EB/WB MP 227-242	- Percent of closures due to Incidents/Accidents, Obstructions/Hazards and Weather Related above statewide average
60E-15	227-225	2	Low	9	6	67%	0	0%	3	33%	None	No projects identified	- Percent of closures due to Weather Related above statewide average
60E-16	225-223	2	Low	5	5	100%	0	0%	0	0%	None	No projects identified	- Percent of closures due to Incidents/Accidents above statewide average
60E-17	223-212	11	None	8	8	100%	0	0%	0	0%	None	Construct new EB lanes MP 219.9-222.3; Construct new WB lanes MP 216.3-219.9; New Queen Valley TI MP 215-214	- Percent of closures due to Incidents/Accidents above statewide average
Statewide HCRS Database Closure Type Average %:					76%		3%		5%				

8.0 SEGMENT REVIEW (STEP 4)

As part of Step 4, the final needs results for each segment were combined to estimate the average level of need for each segment of US 60|US 70|US 191, as described in Section 2.4. During the Corridor Goals and Objectives development process for US 60|US 70|US 191, the Mobility, Safety, and Freight Performance Areas were identified as Emphasis Areas. Therefore, a weighting factor of 1.50 was applied to those performance area needs as discussed in Section 2.4. A summary of the segment needs is shown in **Table 17** along with the resulting average need. These results are intended for use to compare the level of need across corridors. The average level of need by segment is shown for the US 60|US 70|US 191 corridor in **Figure 7**.

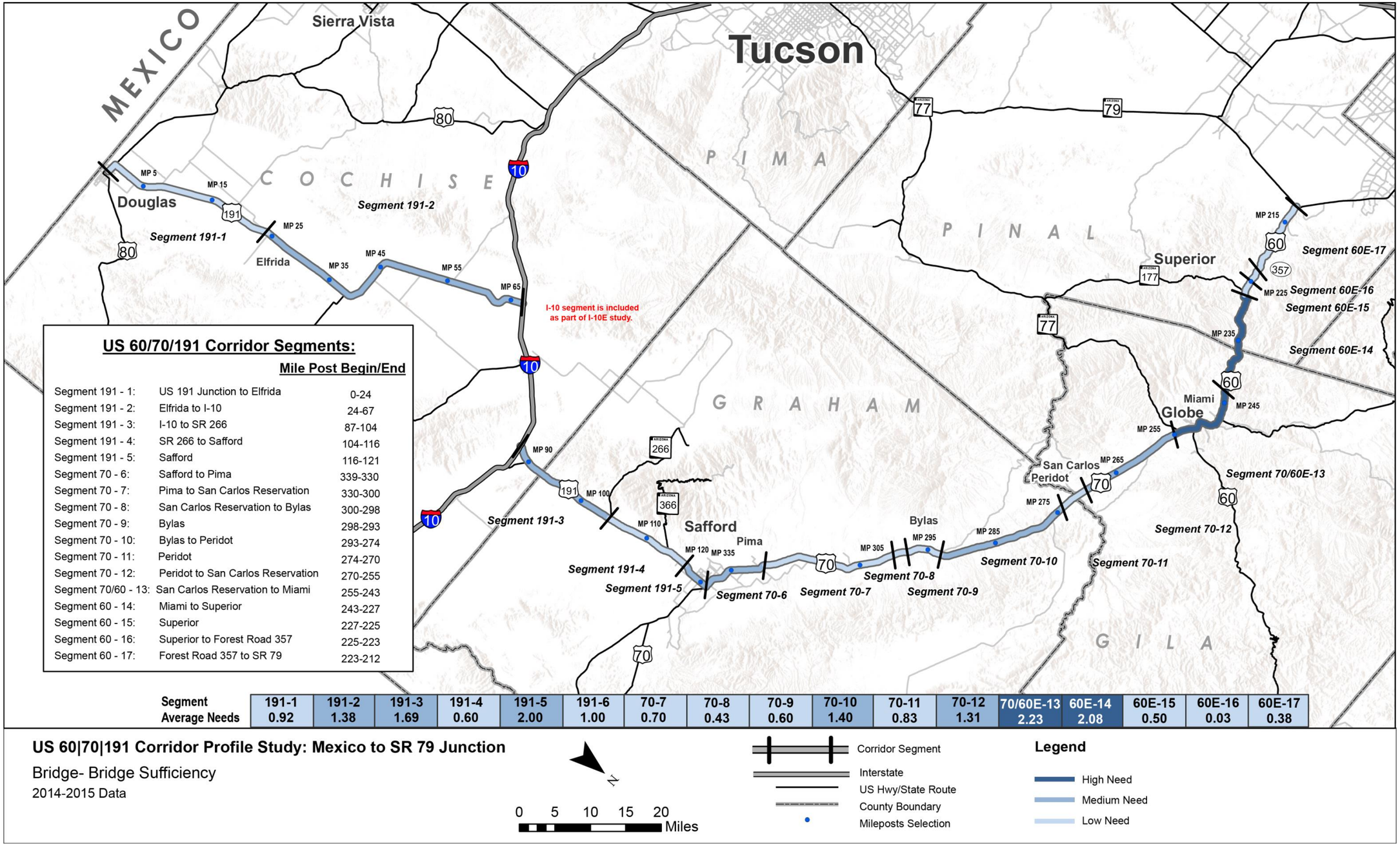
Table 17: Segment Needs Summary

Performance Area	191-1	191-2	191-3	191-4	191-5	70-6	70-7	70-8	70-9	70-10	70-11	70-12	70/60E-13	60E-14	60E-15	60E-16	60E-17
	MP 0-24	MP 24-67	MP 87-104	MP 104-116	MP 116-121	MP 339-330	MP 330-300	MP 300-298	MP 298-293	MP 293-274	MP 274-270	MP 270-255	MP 255-243	MP 243-227	MP 227-225	MP 225-223	MP 223-212
Pavement	None*	Low	Low	Medium	Medium	Low	Low	None*	None*	Low	None*	None*	Low	Low	None*	None*	None*
Bridge	None*	Medium	Low	Low	None*	Low	Low	None*	None*	None*	Low	Low	High	High	Low	None*	Low
Mobility (Emphasis)	Low	Low	Medium	None*	Low	Low	Low	Low	Low	Low	Low	Low	Low	Medium	None*	None*	None*
Safety (Emphasis)	None*	None*	Low	None*	High	Low	None*	N/A	N/A	High	N/A	High	High	Medium	N/A	N/A	Low
Freight (Emphasis)	High	High	High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Low	High	Medium	Low	Low	None*
Average Need (0-3)	**0.92**	**1.38**	**1.69**	**0.60**	**2.00**	**1.00**	**0.70**	**0.43**	**0.60**	**1.40**	**0.83**	**1.31**	**2.23**	**2.08**	**0.50**	**0.30**	**0.38**

Need Category	Average Need Range
Low	0.10 - 1.00
Medium	1.00 - 2.00
High	> 2.00

***A segment need rating of **'None'** does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.

Figure 7: Needs Summary



9.0 CORRIDOR NEEDS (STEP 5)

Step 5 translates the performance-based needs into corridor needs that are "actionable". These needs can facilitate development of solutions (projects, initiatives, countermeasures, and programs) to improve corridor performance through strategic investments in preserving, modernizing, and/or expanding the corridor. Corridor needs were developed through a segment-by-segment review of needs and contributing factors. This review also identified overlapping, common, and contrasting needs across performance areas.

Figure 8 shows the corridor need locations for each performance area and programmed projects for fiscal year (FY) 2017-2021. Programmed projects have not yet been constructed and may address identified needs or be modified as part of the development of strategic investments.

For additional detail on specific needs by location, refer to the information in Step 3.

9.1 Description of Needs by Performance Area

Pavement Needs

The Pavement Performance Area is not an emphasis area for the US 60|US 70|US 191 corridor. Six of 17 segments, 135 miles of the 214 miles (63%) of the corridor, exhibit "Low" level of needs in Pavement Performance. These segments include:

- Segment 191-2, MP 24 – 67
- Segment 191-3, MP 87 – 104
- Segment 70-6, MP 330 – 339
- Segment 70-7, MP 300 – 330
- Segment 70-10, MP 274 – 293
- Segment 70/60E-13, MP 243 – 255
- Segment 60E-14, MP 227-243

Two of the 17 segments, 17 miles (7%) of the corridor, exhibit "Medium" level of need. These segments include:

- Segment 191-4, MP 104 – 116
- Segment 191-5, MP 116 – 121

Pavement hot spot failure needs were identified along the corridor, including areas that have levels of historical investment. Approximately 17 miles on US 191, 3 miles on US 70, and 3 miles on US 60 showed failure needs.

Hot Spots Failures

- US 191 NB MP 24 – 27
- US 191 NB MP 38 – 42
- US 191 NB MP 45 – 46
- US 191 NB MP 48 – 51
- US 191 NB MP 62 – 64
- US 191 NB MP 66 – 67
- US 191 SB MP 87 – 88*
- US 191 NB MP 105 – 107
- US 191 NB MP 120 – 121
- US 70 WB MP 336 – 337
- US 70 WB MP 300 – 301
- US 70 WB MP 283 – 284
- US 60 EB MP 247 – 248
- US 60 EB MP 249 – 251

Low PSR and Composite Scores (poorly performing due to excessive IRI)

- US 191 MP 24 – 27
- US 191 MP 38 – 39
- US 191 MP 40 – 41
- US 191 MP 62 – 64
- US 191 MP 66 – 67
- US 191 MP 105 – 107
- US 191 MP 120 – 121
- US 70 MP 336 – 337
- US 70 MP 283 – 284
- US 60 MP 230 – 233
- US 60 MP 235 – 236

Low PDI and Composite Scores (poorly performing due to excessive cracking)

- US 191 MP 39 – 40
- US 191 MP 45 – 46
- US 191 MP 48 – 51
- US 191 MP 87 – 88
- US 70 MP 300 – 301
- US 60 MP 249 – 251

Two pavement preservation projects are programmed on the corridor, as noted in the following list. Other programmed projects for safety, pathways, climbing lanes, bridge replacement etc. are not listed though they may include some pavement component.

- ADOT H7866 (US 191 MP 87-90) FY2018 – addresses hot spot needs at 1 location*
- ADOT H8700 (US 191 MP 114-118) FY2016

A summary of the historical investment findings is noted below.

- A high level of historical investment has occurred on Segments 70-9 and 70-10 through the San Carlos Indian Reservation
- A medium level of historical investment has occurred through the remaining corridor segments excluding Segment 191-1, which has had overall low investment

Bridge Needs

The Bridge Performance Area is not an emphasis area for the US 60|US 70|US 191 corridor. One of 17 segments of the SR 95 corridor exhibit "Medium" level of need in Bridge Performance. The segment is:

- Segment 191-2, MP 24 – 67

Two of the 17 segments, 28 miles (13%) of the 214-mile corridor, exhibit "High" level of need. These segments include:

- Segment 70/60E-13, MP 243 – 255
- Segment 60E-14, MP 227 – 243

Nine of 51 structures are identified as Hot Spots.

- Holyoak Wash Bridge, US 70 MP 302.53 (No. 514)
- Pinal Creek Bridge, US 60 MP 250.37 (No. 549)
- Pinal Creek Bridge, US 60 MP 249.80 (No. 36)
- Pinal Creek Bridge, US 60 MP 249.64 (No. 266)
- Bloody Tanks Bridge, US 60 MP 243.71 (No. 173)
- Pinto Creek Bridge, US 60 MP 238.25 (No. 351)
- Waterfall Canyon Bridge, US 60 MP 229.50 (No. 328)
- Queen Creek Tunnel, US 60 MP 228.47 (No. 407)
- Queen Creek Bridge, US 60 MP 227.71 (No. 406)

Eight of 51 bridges exhibit high levels of historical bridge maintenance investment.

- Moffet Wash Bridge, US 191 MP 6.44 (No. 297)
- Stockton Wash Bridge, US 191 MP 111.11 (No. 201)
- Black Rock Wash Bridge, US 70 MP 306.76 (No. 545)
- Pinal Creek Bridge, US 60 MP 249.80 (No. 36)
- Pinal Creek Bridge, US 60 MP 249.64 (No. 266)
- Pinto Creek Bridge, US 60 MP 238.25 (No. 351)
- Waterfall Canyon Bridge, US 60 MP 229.50 (No. 328)
- Queen Creek Bridge, US 60 MP 227.71 (No. 406)

There are 3 programmed projects for existing bridges including:

- ADOT H8547 Holyoak Wash Bridge, US 70 MP 302.53 (No. 514) (FY2017)
- ADOT H8547 Matthewsville Wash Bridge, US 70 MP 326.25 (No. 392) (FY2017)
- ADOT H8243 Pinto Creek Bridge, US 60 MP 238.25 (No. 351) (FY2018)

Key contributing factors/needs are summarized below:

- Pinal Creek Bridge, US 60 MP 249.80 (No. 36), as a Deck, Substructure and Structural Evaluation Rating of 5. This bridge is a candidate for life cycle cost analysis and risk assessment to evaluate alternatives ranging from continuing routine maintenance to bridge reconstruction.
- Pinal Creek Bridge, US 60 MP 249.64 (No. 266), has a Deck, Substructure and Structural Evaluation Rating of 4. This bridge is a candidate for life cycle cost analysis and risk assessment to evaluate alternatives ranging from continuing routine maintenance to bridge reconstruction.
- Waterfall Canyon Bridge, US 60 MP 229.50 (No. 328), has a Superstructure and Structural Evaluation rating of 4 plus a Substructure Rating of 5. This bridge is a candidate for life cycle cost analysis and risk assessment to evaluate alternatives ranging from continuing routine maintenance to bridge reconstruction.
- Queen Creek Bridge, US 60 MP 227.71 (No. 406), all Structural Ratings are 4. This bridge is a candidate for life cycle cost analysis and risk assessment to evaluate alternatives ranging from continuing routine maintenance to bridge reconstruction.

Mobility Needs

The Mobility Performance Area is an emphasis area for US 60| US 70| US 191. Two of the segments on the US 60| US 70| US 191 corridor exhibit "Medium" need in Mobility Performance and eleven exhibit "Low" level of need. These include:

Medium Level of Need

- Segment 191-3, MP 87 – 104
- Segment 60E-14, MP 243 – 227

Low Level of Need

- Segment 191-1, MP 0 – 24
- Segment 191-2, MP 24 – 67
- Segment 191-5, MP 116 – 121
- Segment 70-6, MP 339 – 330
- Segment 70-7, MP 330 – 300
- Segment 70-8, MP 300 – 298
- Segment 70-9, MP 298 – 293
- Segment 70-10, MP 293 – 274
- Segment 70-11, MP 274 – 270
- Segment 70-12, MP 270 – 255
- Segment 70/60E-13, MP 255 – 243

Specific locations contributing to the Low, Medium and High mobility ratings related to planning time index (PTI) in the following locations:

NB/WB

- US 191 MP 0 – 104
- US 60 MP 223 – 243

SB/EB

- US 191 MP 0-104
- US 70 MP 270 – 255
- US 60 225 - 243

Planned and programmed projects in this area that may impact these specific needs include:

- DMS NB/SB US 191 MP 2
- DMS SB US 191 MP 90
- DMS NB US 191 MP 116
- ADOT H8397 01C Construct Pedestrian Bridge US 70 MP 329-330
- ADOT H8031 01C / H7637 01C Pathway and intersection improvements US 70 MP 291-300
- ADOT HXXX Construct passing lane US 70 MP 269-271
- DMS EB US 60/70 MP 247
- DMS EB US 60/70 MP 253

Key contributing factors related to mobility needs are summarized below:

- Flooding of the roadway caused closures on US 191 at MP 53 and MP 66
- Concentration of short term closures due to incidents/accidents at the following locations:
  - US 191 from MP 115 – 120,
  - US 70 from MP 259 – 260,
  - US 60 from MP 233 – 242,
  - US 60 from MP 228 – 231.7 (with a high concentration of incidents at MP 230),
  - US 60 from MP 224 – 227, and
  - US 60 from MP 218-220
- Significant number of extended duration closures on US 60 from MP 225 – 228
- Mountainous grades with a lack of passing and climbing lanes on US 60 from MP 227 - 243
- Limited passing, acceleration and deceleration on rolling terrain on US 70 from MP 255 - 330
- Rockfall on US 60 caused repeated incidents of delay and closures between MP 228 – 248
- Weather related delay and closures on US 60 between MP 224-243 due to snow, ice and impassable conditions
- Limited bicycle accommodation on much of the corridor, on US 191 from MP 24 – 104 and MP 116 – 121, and US 60/70 from MP 298 – 243.

Safety Needs

The Safety Performance Area is an emphasis area for US 60| US 70| US 191. Seven of 17 segments of the US 60| US 70| US 191 corridor exhibit needs in Safety Performance. Eight of the 13 segments have Medium or High level of need.

High Level of Need

- Segment 191-5, MP 116 – 121
- Segment 70-10, MP 293 – 274
- Segment 70-12, MP 270 – 255
- Segment 70/60E-13, MP 255 – 243
- Segment 60E-14, MP 243 – 227

Low Level of Need

- Segment 191-3, MP 87 – 104
- Segment 70-6, MP 339 – 330
- Segment 60E-17, MP 223 – 212

Safety needs by segment and the milepost of crash location are summarized below with the key characteristics that exceed statewide average.

- US 191 MP 91, MP 93
  - Involve Overturning
  - Involve Single Vehicle
  - Involve a first unit event of Ran Off the Road (Right)
- 191 MP 118 – 120
  - Involve Collision with Pedestrian
  - Involve Left Turn
  - Involve Failure to Yield Right-of-Way
  - Involve No Improper Action
  - Occur in Dark-Lighted Conditions
  - Under the Influence of Drugs or Alcohol
- US 70 MP 333 – 334, MP 336 – 337, MP 339
  - Involve Collision with Motor Vehicle
  - Involve Rear End
  - Involve Angle
  - Involve Left Turn
  - Involve Disregarded Traffic Signal
  - Inattention/Distraction
  - Involve No Improper Action
- Segment 70-10 MP 274, MP 279, MP 286, MP 292
  - Involve Collision with Motor Vehicle
  - Involve Overturning
  - Involve Single Vehicle
- US 70 MP 258, MP 260, MP 269
  - Involve Collision with Fixed Object
  - Involve Rear-End Collision
  - Involve Single Vehicle
  - Involve Failure to Yield Right-of-Way
  - Involve Inattention/Distraction
  - Involve Speed too Fast for Conditions

- US 60/70 MP 244 – 250, MP 252 – 253
    - Involve Collision with Fixed Object
    - Involve Rear End
    - Involve Single Vehicle
    - Involve Failure to Yield Right-of-Way
    - Involve Inattention/Distraction
    - Involve Speed too Fast for Conditions
- US 60 MP 228 – 236, MP 238 – 241
    - Involve Collision with Fixed Object
    - Involve Single Vehicle
    - Involve Head On
    - Involve Angle
    - Involve Speed too Fast for Conditions
    - Involve No Improper Action
    - Involve Inattention/Distraction

Planned and programmed projects in this area that may impact these specific needs include:

- ADOT H8397 01C Construct Pedestrian Bridge US 70 MP 329-330
- ADOT H8031 01C / H7637 01C Pathway and intersection improvements US 70 MP 291-300
- ADOT HXXXX Construct passing lane US 70 MP 269-271

Key contributing factors to the safety needs are summarized below:

- Fatalities on SB US 191 in the vicinity of MP 91 – 93, which were single vehicle roll over crashes involving high speed
- Both US 191 and US 70 in Safford area, factors included lack of pedestrian lighting and pedestrian facilities, traffic control device reflectivity, intersection geometry, and high traffic volumes
- US 70 from Bylas to Peridot, MP 293 – 274, long stretch of rolling terrain with limited passing lanes and rest areas, with safety factors including shoulder conditions and width, traffic control device reflectivity, clear zone slope and obstructions, and intersection geometry
- US 60/US 70 from Peridot to Superior, lack of passing and climbing lanes, deceleration lanes, pedestrian facilities, intersection geometry, high traffic volumes in urbanized areas with high volume of trucks and motorcycles from MP 227 - 243
- US 60/70 from Globe to Superior, MP 227 – 255, high crash rate due to shoulder conditions, shoulder width, high speeds, clear zone slope and obstructions, high traffic volumes
- US 60 WB from Superior to Florence Junction, MP 223 -212, with safety factors including reduced shoulder conditions and width and potential clear zone slope and obstructions.

Freight Needs

The Freight Performance Area is an emphasis area for US 60| US 70| US 191. Eight of 17 segments of the US 60| US 70| US 191 corridor exhibit needs in Freight Performance. There are seven segments with a High level of need and one with a Low level of need.

High Level of Need

- Segment 191-1, MP 0 – 24
- Segment 191-2, MP 24 – 67
- Segment 191-3, MP 87 – 104
- Segment 70/60E-13, MP 255 – 243
- Segment 60E-14, MP 243 – 227
- Segment 60E-15, MP 227 - 225
- Segment 60E-16, MP 225 - 223

Low Level of Need

- Segment 70-12, MP 270-255

Specific locations contributing to the Low, Medium and High mobility ratings related to planning time index (PTI) in the following locations:

NB/WB

- US 191 MP 0 – 104
- US 60 MP 225 – 255

SB/EB

- US 191 MP 0-104
- US 70 MP 270 – 255
- US 60 225 - 255

Planned and programmed projects in this area that may impact these specific needs include:

- DMS NB/SB US 191 MP 2
- DMS SB US 191 MP 90
- DMS NB US 191 MP 116
- ADOT H8397 01C Construct Pedestrian Bridge US 70 MP 329-330
- ADOT H8031 01C / H7637 01C Pathway and intersection improvements US 70 MP 291-300
- ADOT HXXXX Construct passing lane US 70 MP 269-271
- DMS EB US 60/70 MP 247
- DMS EB US 60/70 MP 253

Similar to Mobility, road closures impact freight performance. These are summarized below that specify focus areas for the US 60| US 70| US 191 corridor.

The number of closures on US 60| US 70| US 191 due to incidents/accidents or obstructions/hazards are above statewide average in the following areas:

- US 191 MP 0 – 67 including flooding at MP 53 and MP 66
- US 191 MP 43 (Border Patrol Check Point)
- Concentration of short term closures due to incidents/accidents at the following locations:
  - Incidents/accidents US 191 MP 115 – 120
  - US 60 from MP 233 – 242,
  - US 60 from MP 228 – 231.7 (with a high concentration of incidents at MP 230), and
  - US 60 from MP 224 – 227
- Significant number of extended duration closures on US 60 from MP 225 – 228
- Mountainous grades with a lack of passing and climbing lanes on US 60 from MP 227 - 243
- Limited passing, acceleration and deceleration on rolling terrain on US 70 from MP 255 - 330
- Rockfall on US 60 caused repeated incidents of delay and closures between MP 228 – 248
- Weather related delay and closures on US 60 between MP 224-243 due to snow, ice and impassable conditions

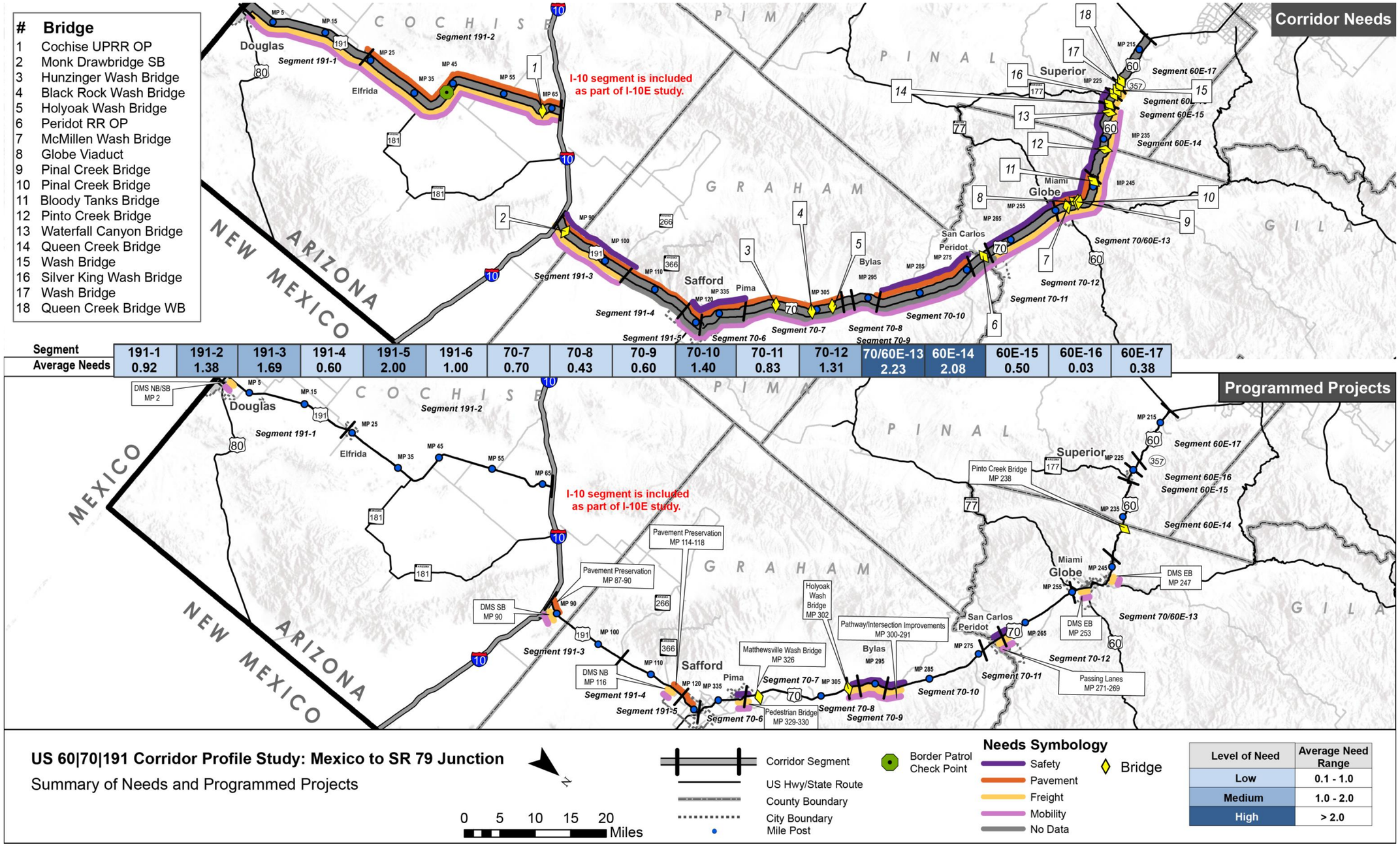
Additionally, clearance restrictions exist at Pinal SPRR UP MP 253.63 (No. 562, height of 15.84') and Queen Creek Tunnel MP 228.47 (height of 13.03').

9.2 Overlapping Needs

This section identifies overlapping performance needs on the US 60|US 70|US 191 corridor, which provides guidance to develop strategic solutions that address more than one performance area. Completing projects that address multiple needs may present the opportunity for cost savings as well as more effectively improving overall performance. The map in **Figure 8** shows the extent of overlapping needs. Overlapping needs are summarized below.

- Most segments on the corridor have overlapping needs, approximately 205 miles of the 214 miles or 96% of the corridor. The exceptions include Segments 70-8, 70-9 and 60E-16. Traffic counters do not exist in Segments 191-4 through 70-11, approximately 75 miles or 35% of the corridor, resulting in insufficient data to calculate needs in the freight performance area for those locations.
- US 191 MP 87 to MP 104 (Segment 191-3) and US 60|70 MP 243 to MP 255 (Segment 70/60E-13) have overlapping needs in all five performance areas. These segments comprised 29 of the 214 corridor miles.
- Segment 191-3 has an overall "Medium" need, with some level of need in all performance areas. The greater needs relate to mobility and freight due to high TTI and PTI related to accidents and incidents. A few closures have long durations that impacted the segment need level. Also noteworthy is that this segment is immediately north of I-10 and utilized when traffic is detoured through Safford during I-10 closures.
- Segment 70/60E-13 has an overall "High" need and the highest need score in the corridor. Some needs are site specific while others are characteristics of the segment. High bridge needs are related to the Pinal Creek Bridge (No. 36) and Pinal Creek Bridge (No. 266), which are hot spots due to poor structural ratings and exhibit high repetitive investment. High safety needs are due to the more urbanized area with increased volumes and speeds too fast for conditions. High freight needs are due to TTI and PTI times, as well as the Pinal SPRR at MP 253.63 have low vertical clearance (15.84').
- Segment 60E-14 also registers an overall "High" need score on the corridor. This segment has significant grades and subsequently suffers from freight and mobility needs related to delay and incidents/accidents associated with the grade. The segment includes 3 hot spot bridges, all of which have repetitive investment histories. The Queen Creek Tunnel, also located in the segment, affects bridge and freight needs with poor deck ratings and low vertical clearance.

Figure 8: Summary of Needs and Programmed Projects



10.0 NEXT STEPS

The principal objective of the corridor profile study is to identify strategic solutions (investments) that are performance-based to ensure that available funds maximize the performance of the State's most strategic transportation corridors.

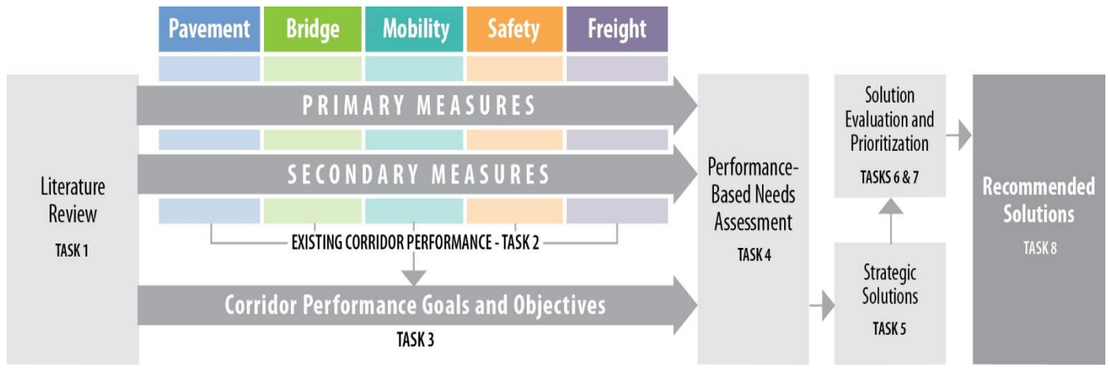
The actionable performance needs documented in Working Paper 4 will serve as a foundation for developing strategic investments for corridor preservation, modernization, and expansion. Strategic investments are not intended to be a substitute or replacement for traditional ADOT project development processes where various candidate projects are developed for consideration in programming in the P2P Link process. Rather, strategic investments are intended to complement ADOT's traditional project development processes with non-traditional projects to address performance needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Strategic investments will be considered along with other candidate projects in the ADOT programming process.

Illustrative examples of strategic investments are:

- ***Projects that address significant performance needs.*** Projects that address a Medium or High performance need identified in the corridor profile study that have a high probability to significantly improve corridor performance may be identified as strategic investments. These projects may include a project in the current program, a planned project not in the current program, or a new project recommended in the corridor profile study.
- ***Projects that address needs in multiple performance areas.*** For example, a single project to rehabilitate the roadway pavement surface and multiple bridge decks on a segment of roadway would address multiple performance areas (Pavement and Bridge) and could result in significant cost savings in traffic control (as compared to traffic control costs for separate projects to rehabilitate pavement surface and bridge decks). Another example would be that a travel lane pavement rehabilitation project could be expanded to include shoulder rehabilitation and rumble strip construction to reduce road departure safety needs.
- ***Projects that address repetitive issues*.** For example, if there is a history of high levels of maintenance activities at a particular bridge or segment of pavement, there may be an underlying need that, if addressed properly, will reduce the need for future maintenance. Higher-cost strategic capital investments to correct repetitive maintenance issues can result in life cycle cost savings by reducing maintenance costs over time.
- ***Phased projects that achieve a long-term improvement objective.*** For example, a life cycle cost analysis may recommend total pavement reconstruction to address a subgrade failure, however the cost of reconstruction may not be feasible from a funding perspective. A strategic investment may be recommended to extend the life of the current pavement infrastructure until funding availability allows for full pavement reconstruction.
- ***Projects that utilize innovative solutions to extend the operational life of infrastructure or improve performance.*** Innovative solutions that modernize a segment of roadway may be identified as strategic investments. Examples of modernization activities include widening of shoulders, access control, replacement/enhancement of infrastructure to address obsolescence, hazard elimination, and the application of various traffic control and management technologies to improve traffic flow at a lower cost than traditional expansion solutions.

Strategic investments will be developed in Task 5 of the corridor profile study to address specific performance needs on US 60|US 70|US 191. In addition, meetings will be conducted with ADOT staff to discuss alternatives for addressing infrastructure performance needs that can be evaluated through a systematic analysis of life cycle costs and risks. **Figure 9** shows the tasks in the Corridor Profile Study process.

Figure 9: Corridor Profile Study Process



APPENDIX A: METHODOLOGIES FOR DETERMINING PERFORMANCE AREA NEEDS (STEPS 1-3)

Pavement Needs Assessment Methodology (Steps 1-3)

This section documents the approach for conducting the first three steps of a 5-step needs assessment process for the Pavement Performance Area. After completion of Step 3 for all performance areas (Pavement, Bridge, Mobility, Safety, and Freight), Step 4 will review each corridor segment to quantify a total level of need that combines all performance areas. Corridor needs are then identified in Step 5 of the process. The 5-step process is listed below:

- Step 1: Initial Needs
- Step 2: Final Needs
- Step 3: Contributing Factors
- Step 4: Segment Review
- Step 5: Corridor Needs

Step 1: Initial Needs

The input required to populate the Step 1 template includes transferring the existing performance score for each segment to the appropriate "Performance Score" columns. This includes the primary and secondary measures for Pavement. As each performance score is input into the template, the Initial Need will populate based on the weighted scoring system for each measure.

The Level of Need for each performance measure has levels of "None" (score = 0), "Low" (score = 1), "Medium" (score = 2), and "High" (score = 3). The assignment of these levels to individual performance measures for segments is determined by the table entitled "Needs Assessment Scales" within the Step 1 template.

To develop an aggregate Initial Need for each segment, the primary and secondary measures are combined by summing the weighted scored, with the primary measure having a weight of 1.0 while each secondary measure has a weight of 0.2 (0.1 each direction if directional). The Initial Need for each segment (combining the primary and secondary measures) has levels of "None" (score < 0.01), "Low" (score ≥ 0.01 and < 1.5), "Medium" (score ≥ 1.5 and < 2.5), and "High" (score ≥ 2.5).

The steps include:

Step 1.1

Enter the appropriate segment information into the columns titled "Segment", "Segment Length", "Segment Mileposts" and "Facility Type".

Step 1.2

Populate the Step 1 template with the existing (baseline) performance scores for all primary and secondary performance measures from Task 2/WP#2 into the appropriate "Performance Score" columns. Copy the performance score for each segment to the appropriate "Performance Score" column. Paste only the "values" and do not overwrite the formatting.

Step 1.3

Indicate if Pavement is an Emphasis Area by selecting "Yes" or "No" in the row immediately below the segment information.

Step 1.4

Confirm that that the Step 1 template is generating the appropriate "Level of Need" for each primary and secondary measure by reviewing the relationship of baseline performance score to level of need.

Step 2: Final Needs

The Initial Need will be carried over to Step 2. The steps required to complete Step 2 are as follows:

Step 2.1

Confirm that the template has properly populated the segment information and the initial needs from the Step 1 template to the "Initial Need" column of the Step 2 template.

Step 2.2

Note in the "Hot Spots" column any pavement failure hot spots identified as part of the baseline corridor performance. For each entry, include the milepost limits of the hot spot. Hot spots are identified in the Pavement Index spreadsheet by the red cells in the columns titled "% Pavement Failure". These locations are based on the following criteria:

Interstates: IRI > 105 or Cracking > 15

Non-Interstates: IRI > 142 or Cracking > 15

Every segment that has a % Pavement Failure greater than 0% will have at least one hot spot. Hot spot locations should be described as extending over consecutive miles. For example, if there is a pavement failure location that extends 5 consecutive miles, it should be identified as one hot spot, not 5 separate hot spots.

Step 2.3

Identify recently completed or under construction paving projects in the "Previous Projects" column. Include only projects that were completed after the pavement condition data period (check dates in pavement condition data provided by ADOT) that would supersede the results of the performance system.

Step 2.5

Update the "Final Need" column using the following criteria:

- If "None" but have a hot spot (or hot spots), the Final Need = Low, and note the reason for the change in the "Comments" column (column H).
- If a recent project has superseded the performance rating data, change the Final Need to "None" and note the reason for the change in the "Comments" column.

Example Scales for Level of Need

Performance Thresholds		Initial Need	Description
3.75		None	(>3.57)
		Low	Middle 1/3rd of Fair Perf. (3.38 - 3.57)
3.2		Medium	Lower 1/3rd of Fair and top 1/3rd of Poor Performance (3.02-3.38)
		High	Lower 2/3rd of Poor Performance (<3.02)

Need Scale for Interstates

Measure	None >=	Low >=	> Medium <		High <=
Pavement Index (corridor non-emphasis area)	3.57	3.38	3.38	3.02	3.02
Pavement Index (corridor emphasis area)	3.93	3.57	3.57	3.20	3.20
Pavement Index (segments)	3.57	3.38	3.38	3.02	3.02
Directional PSR	3.57	3.38	3.38	3.02	3.02
%Pavement Failure	10%	15%	15%	25%	25%

Need Scale for Highways (Non-Interstates)

Measure	None >=	Low >=	> Medium <		High <=
Pavement Index (corridor non-emphasis area)	3.30	3.10	3.10	2.70	2.70
Pavement Index (corridor emphasis area)	3.70	3.30	3.30	2.90	2.90
Pavement Index (segments)	3.30	3.10	3.10	2.70	2.70
Directional PSR	3.30	3.10	3.10	2.70	2.70
%Pavement Failure	10%	15%	15%	25%	25%

Step 2.6

Note any programmed projects that could have the potential to mitigate pavement needs in in the "Comments" column. Programmed projects are provided as information and do not impact the need rating. The program information can be found in ADOT's 5-year construction program. If there are other comments relevant to the needs analysis (such as information from previous reports), they can be entered in the "Comments" column. However, only include information related to needs that have been identified through this process. Do not add or create needs from other sources.

Step 3: Contributing Factors

The Final Need ratings from Step 2 will populate into the Step 3 tab. The steps to complete Step 3 include:

Step 3.1

Input the level of historical investment for each segment. This will be determined from the numeric score from the Pavement History Table based on the following thresholds:

- Low = < 4.60
- Medium = 4.60 – 6.60
- High = > 6.60

If the PeCoS data shows a high level of maintenance investment, increase the historical investment rating by one level.

Step 3.2

Note the milepost ranges of pavement failure hot spots into the column titled "Contributing Factors and Comments."

Step 3.3

Note any other information that may be contributing to the deficiency, or supplemental information, in the "Contributing Factors and Comments" column. This could come from discussions with ADOT District staff, ADOT Materials/Pavement Group, previous reports, or the historical investment data.

Step 3.4

Include any programmed projects from ADOT's 5-year construction program in the "Contributing Factors and Comments" column.

Bridge Needs Assessment Methodology (Steps 1-3)

This section documents the approach for conducting the first three steps of a 5-step needs assessment process for the Bridge Performance Area. After completion of Step 3 for all performance areas (Pavement, Bridge, Mobility, Safety, and Freight), Step 4 will review each corridor segment to quantify a total level of need that combines all performance areas. Corridor needs are then identified in Step 5 of the process. The 5-step process is listed below:

- Step 1: Initial Needs
- Step 2: Final Needs
- Step 3: Contributing Factors
- Step 4: Segment Review
- Step 5: Corridor Needs

Step 1: Initial Needs

The input required to populate the Step 1 template includes transferring the existing performance score for each segment to the appropriate "Performance Score" columns. This includes the primary and secondary measures for Bridge. As each performance score is input into the template, the Initial Need will populate based on the weighted scoring system for each measure.

The Level of Need for each performance measure has levels of "None" (score = 0), "Low" (score = 1), "Medium" (score = 2), and "High" (score = 3). The assignment of these levels to individual performance measures for segments is determined by the table entitled "Needs Assessment Scales" within the Step 1 template.

To develop an aggregated Initial Need for each segment, the primary and secondary measures are combined by summing the weighted scored, with the primary measure having a weight of 1.0 while each secondary measure has a weight of 0.2 (0.1 each direction if directional). The Initial level of need for each segment (combining the primary and secondary measures) has levels of "None" (score < 0.01), "Low" (score $\geq$ 0.01 and < 1.5), "Medium" (score $\geq$ 1.5 and < 2.5), and "High" (score $\geq$ 2.5).

The steps include:

Step 1.1
Enter the appropriate segment information into the columns titled "Segment", "Segment Length", "Segment Mileposts" and "Number of Bridges".

Step 1.2
Populate the Step 1 template with the existing (baseline) performance scores for all primary and secondary performance measures from Task 2/WP#2 into the appropriate "Performance Score" columns. Copy the performance score for each segment to the appropriate "Performance Score" column. Paste only the "values" and do not overwrite the formatting.

Step 1.3
Indicate if Bridge is an Emphasis Area by selecting "Yes" or "No" in the row immediately below the segment information.

Step 1.4
Confirm that that the Step 1 template is generating the appropriate "Level of Need" for each primary and secondary measure by reviewing the relationship of baseline performance score to level of need.

Step 2: Final Needs

The Initial Need will be carried over to Step 2 .The steps required to complete Step 2 are as follows:

Step 2.1
Confirm that the template has properly populated the initial needs from the Step 1 template to the "Initial Need" column of the Step 2 template.

Step 2.2
Note in the column titled "Hot Spots" any bridge hot spots identified as part of the baseline corridor performance. For each entry, note the specific location. Hot spots are identified as having any bridge rating of 4 or less, or multiple ratings of 5 in the deck, substructure, or superstructure ratings.

Step 2.3
Identify recently completed or under construction bridge projects in the "Previous Projects" column. Include only projects that were completed after the bridge condition data period (check dates in bridge condition data provided by ADOT) that would supersede the results of the performance system.

Step 2.4
Update the Final Need on each segment based on the following criteria:

- If the Initial Need is "None" and there is at least one hot spot located on the segment, change the Final Need to "Low".
- If a recent project has superseded the performance rating data, the performance data should be adjusted to increase the specific ratings and the resulting need should be reduced to account for the project.
- Note the reason for any change in the "Comments" column.

Step 2.5
Historical bridge rating data was tabulated and graphed to find any bridges that had fluctuations in the ratings. Note in the "Historical Review" column any bridge that was identified as having a potential historical rating concern based on the following criteria:

- Ratings increase or decrease (bar chart) more than 2 times
- Sufficiency rating drops more than 20 points

This is for information only and does not affect the level of need.

Step 2.6
Note the number of functionally obsolete bridges in each segment in the column titled "# Functionally Obsolete Bridges". This is for information only and does not affect the level of need.

Step 2.7
Identify each bridge "of concern" in the "Comments" column. Note any programmed projects that could have the potential to mitigate bridge needs. Programmed projects are provided as information and do not impact the need rating. The program information can be found in ADOT's 5-year construction program. If there are other comments relevant to the needs analysis (such as information from previous reports), they can be entered in the "Comments" column. However, only include information related to needs that have been identified through this process. Do not add or create needs from other sources.

Example Scales for Level of Need

Bridge Index Performance Thresholds	Level of Need		Description
6.5	Good	None	All of Good Performance and upper 1/3rd of Fair Performance
	Good		
	Good		
	Fair		
	Fair	Low	Middle 1/3rd of Fair Performance
5.0	Fair	Medium	Lower 1/3rd of Fair and top 1/3rd of Poor Performance
	Poor		
	Poor	High	Lower 2/3rd of Poor Performance
	Poor		

Need Scale

Measure	None >=	Low >=	> Medium <		High <=
Bridge Index (corridor non-emphasis area)	6.0	5.5	5.5	4.5	4.5
Bridge Index (corridor emphasis area)	7.0	6.0	6.0	5.0	5.0
Bridge Index (segments)	6.0	5.5	5.5	4.5	4.5
Bridge Sufficiency	70	60	60	40	40
Bridge Rating	6.0	5.0	4.0	4.0	3.0
%Functionally Obsolete Bridges	21.0%	31.0%	31.0%	49.0%	49.0%

Step 3: Contributing Factors

The Final Need ratings from Step 2 will populate into the Step 3 tab. The steps to compete Step 3 include:

Step 3.1
Input the bridge name, structure number, and milepost information for each bridge "of concern" resulting from Step 2.

Step 3.2
For bridges that have a current rating of 5 or less, enter the specific rating, or state "No current ratings less than 6".

Step 3.3
For bridges that were identified for a historical review (step 2.5), state "Could have a repetitive investment issue". If a bridge was not identified for a historical review, state "This structure was not identified in historical review".

Step 3.4
Input any programmed projects from ADOT's 5-year construction program. Note any other information that may be contributing to the deficiency, or supplemental information. This could come from discussions with ADOT District staff, ADOT Bridge Group, or previous reports.

Mobility Needs Assessment Methodology (Steps 1-3)

This section documents the approach for conducting the first three steps of a 5-step needs assessment process for the Mobility Performance Area. After completion of Step 3 for all performance areas (Pavement, Bridge, Mobility, Safety, and Freight), Step 4 will review each corridor segment to quantify a total level of need that combines all performance areas. Corridor needs are then identified in Step 5 of the process. The 5-step process is listed below:

- Step 1: Initial Needs
- Step 2: Refined Needs
- Step 3: Contributing Factors
- Step 4: Segment Review
- Step 5: Corridor Needs

Step 1: Initial Needs

The input required to populate the Step 1 template includes transferring the existing performance score for each segment to the appropriate "Performance Score" columns from Task 2/Working Paper #2. This includes the primary and secondary measures for Mobility. As each performance score is input into the template, the Initial Need will populate based on the weighted scoring system for each measure.

The Level of Need for each performance measure has levels of "None" (score = 0), "Low" (score = 1), "Medium" (score = 2), and "High" (score = 3). The assignment of these levels to individual performance measures for segments is determined by the table entitled "Needs Assessment Scales" in the Step 1 tab.

To develop an aggregated Initial Need for each segment, the primary and secondary measures are combined by summing the weighted scores, with the primary measure having a weight of 1.0 while each secondary measure has a weight of 0.2 (0.1 each direction if directional). The Initial Need for each segment (combining the primary and secondary measures) has levels of "None" (score < 0.01), "Low" (score $\geq$ 0.01 and < 1.5), "Medium" (score $\geq$ 1.5 and < 2.5), and "High" (score $\geq$ 2.5).

The steps include:

Step 1.1
Input the accurate number of segments for your corridor in the column titled 'Segment' and the appropriate segment milepost limits and segment lengths in adjacent columns.

Step 1.2
Select the appropriate 'Environment Type' and 'Facility Operation Type' from the drop down menus as defined in Task 2 - Existing Performance Analysis.

Step 1.3
Select 'Yes' or 'No' form the drop down list to not if the Mobility Performance Area is an Emphasis Area for your corridor.

Step 1.4
Populate the Step 1 template with the existing (baseline) performance scores for all primary and secondary performance measures from Task 2/Working Paper #2. Copy the performance score for each segment to the appropriate "Performance Score" column.

Step 1.5
Confirm that that the Step 1 template is generating the appropriate "Level of Need" for each primary and secondary measure by reviewing the relationship of baseline performance score to level of need.

Step 2: Final Needs

The Initial Need will be carried over to Step 2 The steps required to complete Step 2 are as follows:

Step 2.1
Confirm that the template has properly populated the initial deficiencies from the Step 1 template to the Step 2 template.

Step 2.2
Identify recently completed or under construction projects that would be considered relevant to mobility performance. Include only projects that were constructed after 2014 for which the 2014 HPMS data used for traffic volumes would not include. Any completed or under construction roadway project after 2014 that has the potential to mitigate a mobility issue on a corridor segment should be listed in the template. Such projects should include the construction of new travel lanes or speed limit changes on the main corridor only. Do not include projects involving frontage roads or crossings as they would not impact the corridor level performance.

Step 2.3
Update the Final Need using the following criteria:

- If a recent project has superseded the performance rating data and it is certain the project addressed the deficiency, change the need rating to "None".
- If a recent project has superseded the performance rating data but it is uncertain that a project addressed the need, maintain the current deficiency rating and note the uncertainty as a comment.

Step 2.4
Note any programmed or planned projects that have the potential to mitigate any mobility needy on the segment. Programmed and Planned projects are provided as information and do not impact the deficiency rating. Future projects will be reviewed in the development of solution sets for identified needs and deficiencies. The source of future projects can be found in ADOT's 5-year construction program or other planning documents. Other comments relevant to the needs analysis can be entered.

Example Scales for Level of Need

Performance Thresholds	Initial Need		Description
0.71		None	(<0.77)
		Low	Middle 1/3rd of Fair Perf. (0.77 - 0.83)
0.89		Medium	Lower 1/3rd of Fair and top 1/3rd of Poor Performance (0.83-0.95)
		High	Lower 2/3rd of Poor Performance (>0.95)

Needs Scale

Measure		None <=	Low >=	> Medium <		High <=
Mobility Index (Corridor Emphasis Area)		Weighted calculation for the segment totals in corridor (urban vs. rural)				
Mobility Index (Corridor Non-Emphasis Area)		Weighted calculation for the segment totals in corridor (urban vs. rural)				
Mobility Index (Segment)	Urban	0.77	0.83	0.83	0.95	0.95
	Rural	0.63	0.69	0.69	0.83	0.83
Future Daily V/C	Urban	0.77	0.83	0.83	0.95	0.95
	Rural	0.63	0.69	0.69	0.83	0.83
Existing Peak hour V/C	Urban	0.77	0.83	0.83	0.95	0.95
	Rural	0.63	0.69	0.69	0.83	0.83
Closure Extent		0.35	0.49	0.49	0.75	0.75
Directional TTI	Uninterrupted	1.21	1.27	1.27	1.39	1.39
	Interrupted	1.53	1.77	1.77	2.23	2.23
Directional PTI	Uninterrupted	1.37	1.43	1.43	1.57	1.57
	Interrupted	4.00	5.00	5.00	7.00	7.00
Bicycle Accommodation		80%	70%	70%	50%	50%

Step 3: Contributing Factors

The Final Need ratings from Step 2 will populate into the Step 3 tab. The steps to compete Step 3 include:

Step 3.1
Input data from Mobility Index worksheet and corridor observations in appropriate columns for Roadway Variables.

Step 3.2
Input traffic variable data in appropriate columns as indicated, Buffer Index scores will auto populate.

Step 3.3
Input relevant mobility related infrastructure located within each segment as appropriate

Step 3.4
Input the Closure Extents that have occurred along the study corridor. Road closure information can be detailed out by the reason for the closure as documented in Highway Condition Reporting System (HCRS) data analyzed as part of the baseline corridor performance. Closure reasons include incident/accidents, winter storms, obstruction hazards, and undefined closures. Statewide average percentages for the various closure reasons have been calculated for 2009-2013 on ADOT's 11 designated strategic corridors. Compare these statewide average percentages to the corridor percentages for the various closure reasons to identify higher than average percentages of one or more closure reasons on any given segment. Input the closures as follows and use red text to indicate that the segment percentage exceeds statewide averages:

- Total Number of Closures
- % Incidents/Accidents
- % Obstructions/Hazards
- % Weather Related

Step 3.5
List the non-actionable conditions that are present within each segment by milepost if possible. Non-Actionable conditions are conditions that exist within the environment of each segment that cannot be improved through an engineered solution.

Step 3.6
Considering all information input, identify and list the contributing factors to the Final Need score.

Safety Needs Assessment Methodology (Steps 1-3)

This section documents the approach for conducting the first three steps of a 5-step needs assessment process for the Safety Performance Area. After completion of Step 3 for all performance areas (Pavement, Bridge, Mobility, Safety, and Freight), Step 4 will review each corridor segment to quantify a total level of need that combines all performance areas. Corridor needs are then identified in Step 5 of the process. The 5-step process is listed below:

- Step 1: Initial Needs
- Step 2: Final Needs
- Step 3: Contributing Factors
- Step 4: Segment Review
- Step 5: Corridor Needs

Step 1: Initial Needs

The input required to populate the Step 1 template includes transferring the corridor characteristics and existing performance score for each segment to the appropriate "Performance Score" columns. This includes the primary and secondary measures for safety. As each performance score is input into the template, the Level of Need will populate based on the weighted scoring system for each measure.

The Level of Need for each performance measure has levels of "None" (score = 0), "Low" (score = 1), "Medium" (score = 2), and "High" (score = 3). The assignment of these levels to individual performance measures for segments is determined by the table entitled "Needs Scale" within the Step 1 template.

To develop an aggregated Initial Need for each segment, the primary and secondary measures are combined by summing the weighted scored, with the primary measure having a weight of 1.0 while each secondary measure has a weight of 0.2 (0.1 each direction if directional). The Initial Need for each segment (combining the primary and secondary measures) has levels of "None" (score < 0.01), "Low" (score ≥ 0.01 and < 1.5), "Medium" (score ≥ 1.5 and < 2.5), and "High" (score ≥ 2.5).

The steps include:

Step 1.1
Populate the Step 1 template with the corridor characteristics information. This includes segment operating environments and segment length. Also specify if the safety performance area is an emphasis area as determined in Task 3. The "Level of Need" is dependent on the input of the operating environment and "Emphasis Area" as the thresholds dynamically update accordingly.

Input the existing (baseline) performance scores for all primary and secondary performance measures from Task 2. Copy the performance score (paste values only) for each segment to the appropriate "Performance Score" column and conditional formatting should color each cell green, yellow, or red based on the corresponding performance thresholds.

Step 1.2
The thresholds for the corridor safety index are based on the segments' operating environments. To ensure that the correct corridor safety index threshold are applied, input the unique segment operating environments that exist with the corridor. Once the input is complete, the average of the Good/Fair and Fair/Poor thresholds for each of the operating environments is calculated and the "Level of Need" thresholds will be derived and applied to the main Step 1 Table.

Step 1.3
Confirm that the following criteria for "Insufficient Data" has been applied and that the resulting Level of Need has been shown as "N/A" where applicable.

- Crash frequency for a segment is less than 5 crashes over the 5-year crash analysis period.
- The change in +/- 1 crash results in the change of need level of 2 levels (i.e., changes from Good to Poor or changes from Poor to Good).
- The average segment crash frequency for the overall corridor (total fatal plus incapacitating injury crash frequency divided by the number of corridor segments) is less than 2 per segment over the 5-year crash analysis period.

Step 1.4
Confirm that the Step 1 template is generating the appropriate "Level of Need" for each primary and secondary measure by reviewing the relationship of baseline performance score to level of need.

Step 2: Final Needs

The Initial Need will be carried over to Step 2. The steps required to complete Step 2 are as follows:

Step 2.1
Confirm that the template has properly populated the initial needs from the Step 1 template to the Step 2 template**.**

Step 2.2
Using the crash concentration (hot spot) map developed as part of the baseline corridor performance, note the direction of travel and approximate milepost limits of each hot spot.

Step 2.3
Identify recently completed or under construction projects that would be considered relevant to safety performance. Include only projects that were not taken into account during the crash data analysis period (2009 – 2013). Any completed or under construction roadway project after 2013 that has the potential to mitigate a safety issue on a corridor segment should be listed in the template. Sources of recent or current project activity can include ADOT MPD staff, ADOT public notices, and ADOT District staff.

Step 2.4
Update the Final Need based on the following criteria:

- If there is a crash hot spot concentration on a “None” segment, upgrade the need rating to “Low”.

Step 2.5

Note any programmed projects that could have the potential to mitigate any safety need on the segment. Programmed projects are provided as information and do not impact the need rating. Programmed projects will be reviewed in the development of solution sets for identified needs. The source of the programming information can be found in ADOT’s 5-year construction program. Any other relevant issues identified in previous reports should also be reported.

Needs Scale

Measure		None <=	Low <=	< Medium >		High >=	Good/Fair Threshold	Fair/Poor Threshold
Corridor Safety Index (Emphasis Area)		Weighted average based on operating environment type						
Corridor Safety Index (Non-Emphasis Area)		# Weighted average based on operating environment type					#DIV/0!	#DIV/0!
Safety Index and Directional Safety Index (Segment)	2 or 3 Lane Undivided Highway	0.98	1.02	1.02	1.10	1.10	0.94	1.06
	2 or 3 or 4 Lane Divided Highway	0.92	1.07	1.07	1.38	1.38	0.77	1.23
	4 or 5 Lane Undivided Highway	0.93	1.06	1.06	1.33	1.33	0.8	1.2
	6 Lane Highway	0.85	1.14	1.14	1.73	1.73	0.56	1.44
	Rural 4 Lane Freeway with Daily Volume < 25,000	0.91	1.09	1.09	1.45	1.45	0.73	1.27
	Rural 4 Lane Freeway with Daily Volume > 25,000	0.89	1.1	1.1	1.53	1.53	0.68	1.32
	Urban 4 Lane Freeway	0.93	1.07	1.07	1.35	1.35	0.79	1.21
	Urban or Rural 6 Lane Freeway	0.94	1.06	1.06	1.3	1.3	0.82	1.18
	Urban > 6 Lane Freeway	0.93	1.06	1.06	1.33	1.33	0.8	1.2
% of Fatal + Incap. Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	2 or 3 Lane Undivided Highway	53%	55%	55%	59%	59%	51%	57%
	2 or 3 or 4 Lane Divided Highway	47%	50%	50%	57%	57%	44%	54%
	4 or 5 Lane Undivided Highway	45%	48%	48%	54%	54%	42%	51%
	6 Lane Highway	39%	43%	43%	50%	50%	35%	46%
	Rural 4 Lane Freeway with Daily Volume < 25,000	46%	49%	49%	56%	56%	43%	53%
	Rural 4 Lane Freeway with Daily Volume > 25,000	46%	51%	51%	62%	62%	41%	57%
	Urban 4 Lane Freeway	52%	55%	55%	62%	62%	49%	59%
	Urban or Rural 6 Lane Freeway	42%	50%	50%	65%	65%	34%	57%
	Urban > 6 Lane Freeway	47%	51%	51%	59%	59%	43%	55%
% of Fatal + Incap. Injury Crashes Involving Trucks	2 or 3 Lane Undivided Highway	6%	7%	7%	8%	8%	5%	7%
	2 or 3 or 4 Lane Divided Highway	5%	6%	6%	8%	8%	4%	7%
	4 or 5 Lane Undivided Highway	7%	8%	8%	11%	11%	6%	10%
	6 Lane Highway	3%	6%	6%	12%	12%	0%	9%
	Rural 4 Lane Freeway with Daily Volume < 25,000	14%	15%	15%	18%	18%	13%	17%
	Rural 4 Lane Freeway with Daily Volume > 25,000	9%	11%	11%	15%	15%	7%	13%
	Urban 4 Lane Freeway	8%	9%	9%	12%	12%	7%	11%
	Urban or Rural 6 Lane Freeway	8%	10%	10%	13%	13%	6%	11%
	Urban > 6 Lane Freeway	4%	5%	5%	7%	7%	3%	6%
% of Fatal + Incapacitating Injury Crashes Involving Motorcycles	2 or 3 Lane Undivided Highway	22%	25%	25%	30%	30%	19%	27%
	2 or 3 or 4 Lane Divided Highway	19%	22%	22%	29%	29%	16%	26%
	4 or 5 Lane Undivided Highway	7%	8%	8%	10%	10%	6%	9%
	6 Lane Highway	7%	14%	14%	27%	27%	0%	20%
	Rural 4 Lane Freeway with Daily Volume < 25,000	6%	7%	7%	9%	9%	5%	8%
	Rural 4 Lane Freeway with Daily Volume > 25,000	11%	14%	14%	20%	20%	8%	17%
	Urban 4 Lane Freeway	10%	11%	11%	13%	13%	9%	12%
	Urban or Rural 6 Lane Freeway	9%	11%	11%	15%	15%	7%	13%
	Urban > 6 Lane Freeway	15%	17%	17%	22%	22%	13%	20%
% of Fatal _ Incapacitating Injury Crashes Involving Non-Motorized Travelers	2 or 3 Lane Undivided Highway	3%	4%	4%	5%	5%	2%	4%
	2 or 3 or 4 Lane Divided Highway	3%	4%	4%	5%	5%	2%	4%
	4 or 5 Lane Undivided Highway	6%	7%	7%	9%	9%	5%	8%
	6 Lane Highway	11%	14%	14%	20%	20%	8%	17%
	Rural 4 Lane Freeway with Daily Volume < 25,000	2%	2%	2%	3%	3%	1.7%	2.5%
	Rural 4 Lane Freeway with Daily Volume > 25,000	0%	0%	0%	0%	0%	0%	0%
	Urban 4 Lane Freeway	7%	9%	9%	12%	12%	5%	10%
	Urban or Rural 6 Lane Freeway	3%	5%	5%	9%	9%	1%	7%
	Urban > 6 Lane Freeway	1%	1%	1%	2%	2%	0.5%	1.5%

Step 3: Contributing Factors

The Final Need ratings from Step 2 will populate into the Step 3 tab.

Table 3 - Step 3 Template
A separate *Crash Summary Sheet* file contains summaries for 8 crash attributes for the entire corridor, for each corridor segment, and for statewide roadways with similar operating environments (the database of crashes on roadways with similar operating environments was developed in Task 2 (the baseline corridor performance)). The crash attribute summaries are consistent with the annual ADOT Publication, *Crash Facts*. The 8 crash attribute summaries consist of the following:

- First Harmful Event (FHET)
- Crash Type (CT)
- Violation or Behavior (VB)
- Lighting Condition (LC)
- Roadway Surface Type (RST)
- First Unit Event (FUE)
- Driver Physical Condition (Impairment)
- Safety Device Usage (Safety Device)

Non-colored tabs in this spreadsheet auto-populate with filtered crash attributes. Each tab is described below:

- **Step_3_Summary** – This tab contains the filtered summary of crashes that exceed statewide thresholds for crashes on roadways with similar operating environments. Data in this tab are copied into the Step 3 template.
- **Statewide** – This tab contains a summary of statewide crashes from roadways with similar operating environments filtered by the 8 crash type summaries listed above. The crash type summaries calculate statewide crash thresholds (% total for fatal plus incapacitating crashes). The crash thresholds were developed to provide a statewide expected proportion of crash attributes against which the corridor segments' crash attributes can be compared. The crash thresholds were developed using the *Probability of Specific Crash Types Exceeding a Threshold Proportion* as shown in the Highway Safety Manual, Volume 1 (2010). The thresholds are automatically calculated within the spreadsheet. The threshold proportion was calculated as follows:

$$p*_i = \frac{\sum N_{Observed,i}}{\sum N_{Observed,i(total)}}$$

Where:

$p*_i$ = Threshold proportion

$\sum N_{Observed,i}$ = Sum of observed target crash frequency within the population

$\sum N_{Observed,i(total)}$ = Sum of total observed crash frequency within the population

A minimum crash sample size of 5 crashes over the 5-year crash analysis period is required for a threshold exceedance to be displayed in the Step 3 template. The probability of exceeding the crash threshold was not calculated to simplify the process.

- **Corridor –** A summary of corridor-wide crashes filtered by the 8 crash attribute summaries listed above.
- **Segment FHET** – A segment-by-segment summary of crashes filtered by first harmful event attributes.
- **Segment CT** – A segment-by-segment summary of crashes filtered by crash type attributes.
- **Segment VB** - A segment-by-segment summary of crashes filtered by violation or behavior attributes.
- **Segment LC** – A segment-by-segment summary of crashes filtered by lighting condition attributes.
- **Segment RST** – A segment-by-segment summary of crashes filtered by roadway surface attributes.
- **Segment FUE** – A segment-by-segment summary of crashes filtered by first unit event attributes.
- **Segment Impairment** – A segment-by-segment summary of crashes filtered by driver physical condition attributes related to impairment.
- **Segment Safety Device** – A segment-by-segment summary of crashes filtered by safety device usage attributes.

The steps to compete Step 3 include:

Step 3.1
Using the Crash_Summary_Sheet.xlsx, go to the "Step_3_Summary" tab. Input the operating environments for each segment in the table.

Step 3.2
Filter data from the ADOT database for the "CORRIDOR_DATA" tab by inserting the following data in the appropriate columns that are highlighted in gray for the "INPUT_CORRIDOR_DATA" tab:

- Incident ID
- Incident Crossing Feature (MP)
- Segment Number (Non-native ADOT data – must be manually assigned based on the location of the crash)
- Operating Environment (Non-native ADOT data – should already be assigned but if for some reason it isn't, it will need to be manually assigned)
- Incident Injury Severity
- Incident First Harmful Description
- Incident Collision Manner
- Incident Lighting Condition Description

- Unit Body Style
- Surface Condition
- First Unit Event Sequence
- Person Safety Equipment
- Personal Violation or Behavior
- Impairment

Note that columns highlighted in yellow perform a calculated input to aggregate specific crash descriptions. For example, crashes can contain various attributes for animal-involved crashes. The crash attributes that involve an animal were combined into a common attribute, such as "ANIMAL". This will allow the summaries to be consistent with the ADOT *Crash Facts*.

The data in the Impairment category contains blank descriptions if it was found that there was "No Apparent Influence" or if it was "Unknown". Using the crash data fields "PersonPhysicalDescription" 0 - 99, fill in the blank columns to reflect if the physical description is described as "No Apparent Influence" or "Unknown". Note that the native physical description data from the ADOT database may need to be combined to a single column.

Step 3.3
Confirm that the crash database is being properly filtered by comparing crash frequencies from the summary tables with the frequencies developed in Task 2. For example, the lookup function will fail if the filter is for "NO IMPROPER ACTION" if the database has the attribute of "NO_IMPROPER_ACTION".

Step 3.4
Copy and paste the Step_3_Summary into the Task 4 – Safety Needs Assessment spreadsheet in the Step 3 tab. Paste values only and remove the summaries with "0%s" for a clean display. Where duplicate values exist, go to the "Calcs" tab in the Crash_Summary_Sheet file to determine which categories have the same %. If there are more crash types with the same % than there is space in the table, select the crash type with the highest difference between the segment % and the statewide average %

Step 3.5
The Step 3 table in the Task 4 – Safety Needs Assessment spreadsheet should be similar to the Step 3 template. In the Segment Crash Summaries row, the top three crash attributes are displayed. Change the font color of the crash attributes that exceed the statewide crash threshold to red for emphasis. The attributes with a red font in the "Calcs" tab have exceeded statewide crash thresholds. Note that corridor-wide values are not compared to statewide values as corridor-wide values are typically a blend of multiple similar operating environments while the statewide values apply to one specific similar operating environment.

Step 3.6
Provide a summary of any observable patterns found within the crash Hot Spots, if any exist in the segments.

Step 3.7
Input any historic projects (going no further back than 2000) that can be related to improving safety. Projects more than five years old may have exceeded their respective design life and could be contributing factors to safety performance needs.

Step 3.8
Input key points from District interviews or any important information from past discussions with District staff that is consistent with needs and crash patterns identified as part of the performance and needs assessment as this may be useful in identifying contributing causes. This information may be obtained from District Maintenance personnel by requesting the mile post locations that may be considered safety issues.

Step 3.9
For segments with one or more of the following characteristics, review crashes of all severity levels (not just fatal and incapacitating injury crashes). Identify likely contributing factors and compare that to the above statewide average comparison findings already calculated for fatal and incapacitating injury crashes. Refine the contributing factors list accordingly.

- Segments with Medium or High need
- Segments with a crash hot spot concentration (but only review crashes at the concentration areas)
- Segments with no apparent predominant contributing factors based on the comparison of fatal and incapacitating crashes to statewide averages if the segment has a Medium or High need.

Step 3.10
Considering all information in Steps 1-3, list the contributing factors using engineering judgment and the information on contributing factors available in Section 6.2 of the 2010 Highway Safety Manual. Additional sources for determining contributing factors may include aerial, "streetview", and/or ADOT photologs. Other documents such as Design Concept Reports (DCR) or Road Safety Assessments can provide insight into the study corridor's contributing factors.

Add comments as needed on additional information related to contributing factors that may have been provided by input from ADOT staff.

Freight Needs Assessment Methodology (Steps 1-3)

This section documents the approach for conducting the first three steps of a 5-step needs assessment process for the Freight Performance Area. After completion of Step 3 for all performance areas (Pavement, Bridge, Mobility, Safety, and Freight), Step 4 will review each corridor segment to quantify a total level of need that combines all performance areas. Corridor needs are then identified in Step 5 of the process. The 5-step process is listed below:

- Step 1: Initial Needs
- Step 2: Final Needs
- Step 3: Contributing Factors
- Step 4: Segment Review
- Step 5: Corridor Needs

Step 1: Initial Needs

The input required to populate the Step 1 template includes transferring the existing performance score and color for each segment to the appropriate "Performance Score" columns. This includes the primary and secondary measures for Freight. As each performance score is input into the template, the Initial Need will populate based on the weighted scoring system for each measure.

The Level of Need for each performance measure has levels of "None" (score = 0), "Low" (score = 1), "Medium" (score = 2), and "High" (score = 3). The assignment of these levels to individual performance measures for segments is determined by the table entitled "Needs Assessment Scale" within the Step 1 template.

To develop an aggregated Initial Need for each segment, the primary and secondary measures are combined by summing the weighted score, with the primary measure having a weight of 1.0 while each secondary measure has a weight of 0.2 (0.1 each direction if directional). The Initial Need for each segment (combining the primary and secondary measures) has levels of "None" (score < 0.01), "Low" (score ≥ 0.01 and < 1.5), "Medium" (score ≥ 1.5 and < 2.5), and "High" (score ≥ 2.5).

The steps include:

Step 1.1
Populate the Step 1 template with the existing (baseline) performance scores for all primary and secondary performance measures from Task 2. Copy the performance score for each segment to the appropriate "Performance Score" column. Select the *Facility Operations* for each segment from the drop-down list and input whether or not the performance area is an emphasis area. The corridor needs assessment scales will be updated automatically.

Step 1.2
Confirm that that the Step 1 template is generating the appropriate "Level of Need" for each primary and secondary measure by reviewing the relationship of baseline performance score to level of need.

Step 2: Final Needs

The Initial Need will be carried over to Step 2. The steps required to complete Step 2 are as follows:

Step 2.1
Confirm that the template has properly populated the initial need from the Step 1 template to the Step 2 template.

Step 2.2
Note any truck height restriction hot spots (clearance < 16') identified as part of the baseline corridor performance. For each entry, note the milepost of the height restriction and if the height restriction can be detoured by ramping around the obstruction. If it is not possible for a truck to ramp around the height restriction, note the existing height as well.

Step 2.3
Identify recently completed or under construction projects that would be considered relevant to freight performance. Include only projects that were not taken into account during the freight data analysis period. Any completed or under construction roadway project after the date of the data that has the potential to mitigate a freight issue on a corridor segment should be listed in the template. Such projects can include the construction of climbing lanes or Dynamic Message Signs (DMS) installation. Sources of recent or current project activity can be ADOT MPD staff, ADOT public notices, and ADOT District staff.

Step 2.4
Update the Final Need using the following criteria:

- If there is one or more truck height restriction hot spots where a truck cannot ramp around on a 'None' segment, increase (i.e., worsen) the need rating to 'Low'.
- If a recent project has superseded the performance rating data and it is certain the project addressed the need, change the need rating to "None".
- If a recent project has superseded the performance rating data but it is uncertain that a project addressed the need, maintain the current need rating and note the uncertainty as a comment.

Step 2.5
Note any programmed projects that could have the potential to mitigate any freight need on the segment. Programmed projects are provided as information and do not impact the need rating. Programmed projects will be reviewed in the development of solution sets for identified needs. The source of the programming information can be found in ADOT's 5-year construction program. If there are other comments relevant to the needs analysis, they can be entered in the right-most column.

Example Scales for Level of Need - Freight Index

Performance Score Thresholds	Performance Level	Initial Performance Level of Need	Description (Non-emphasis Area)
	Good	None	All levels of Good and the top third of Fair (>0.74)
	Good		
0.77	Good		
0.74	Fair		
0.70	Fair	Low	Middle third of Fair (0.70-0.74)
0.67	Fair	Medium	Lower third of Fair and top third of Poor (0.64-0.70)
0.64	Poor		
	Poor	High	Lower two-thirds of Poor (<0.64)
	Poor		

Needs Scale

Measure	None >=	> Low <		> Medium <		High <=
Corridor Freight Index (Emphasis Area)	Dependent on weighted average of interrupted vs. uninterrupted segments					
Corridor Freight Index (Non-Emphasis Area)	Dependent on weighted average of interrupted vs. uninterrupted segments					
Freight Index (Segment)						
Measure	**None >=**	**> Low <**		**> Medium <**		**High <=**
Interrupted	0.28	0.28	0.22	0.22	0.12	0.12
Uninterrupted	0.74	0.74	0.70	0.70	0.64	0.64
Measure	**None <=**	**< Low >**		**< Medium >**		**High >=**
Directional TTI						
Interrupted	1.53	1.53	1.77	1.77	2.23	2.23
Uninterrupted	1.21	1.21	1.27	1.27	1.39	1.39
Directional PTI						
Interrupted	4.00	4.00	5.00	5.00	7.00	7.00
Uninterrupted	1.37	1.367	1.43	1.43	1.57	1.57
Closure Duration						
All Facility Operations	71.07	71.07	97.97	97.97	151.75	151.75
Measure	**None >=**	**> Low <**		**> Medium <**		**High <=**
Bridge Clearance (feet)						
All Bridges	16.33	16.33	16.17	16.17	15.83	15.83

Step 3: Contributing Factors

The Final Need ratings from Step 2 will populate into the Step 3 tab.

The steps to compete Step 3 include:

Step 3.1
Input all roadway variable data that describe each segment into the appropriate columns. Note that this data can be copied from the Mobility Needs Assessment spreadsheet for Task 4.

Step 3.2
Input all traffic variables for each segment into the appropriate columns. The Buffer Index will auto populate based on the TPTI and TTTI input in the Step 1 tab. Note that this data can be copied from the Mobility Needs Assessment spreadsheet for Task 4.

Step 3.3
Input any freight-related infrastructure that currently exists on the corridor for each segment. The relevant infrastructure can include DMS locations, weigh stations, Ports of Entry (POE), rest areas, parking areas, and climbing lanes. Include the mileposts of the listed infrastructure. This data can be extracted from the most recent Highway Log and the 2015 Climbing and Passing Lane Prioritization Study.

Step 3.4
Input the Closure Extents that have occurred along the study corridor. Road closure information can be detailed out by the reason for the closure as documented in Highway Condition Reporting System (HCRS) data analyzed as part of the baseline corridor performance. Closure reasons include incident/accidents, winter storms, obstruction hazards, and undefined closures. Statewide average percentages for the various closure reasons have been calculated for the analysis period on ADOT's 11 designated strategic corridors. Compare these statewide average percentages to the corridor percentages for the various closure reasons to identify higher than average percentages of one or more closure reasons on any given segment. Note that this data can be copied from the Mobility Needs Assessment spreadsheet for Task 4. Input the closures as follows and use red text to indicate that the segment percentage exceeds statewide averages:

- Total Number of Closures
- % Closures (No Reason)
- % Incidents/Accidents
- % Obstructions/Hazards
- % Weather Related

Step 3.5
List the non-actionable conditions that are present within each segment by milepost if possible. Non-Actionable conditions are conditions that exist within the environment of each segment that cannot be improved through an engineered solution. Examples of Non-Actionable conditions can include border patrol check points and other closures/restrictions not controlled by ADOT. Note that this data can be copied from the Mobility Needs Assessment spreadsheet for Task 4.

Step 3.6
Input any programmed and planned projects or issues that have been identified from previous documents or studies that are relevant to the Final Need. Sources for this data include the current Highway Log, the 2015 Climbing and Passing Lane Prioritization Study, and ADOT's 5-year construction program.

Step 3.7
Considering all information in Steps 1-3, identify the contributing factors to the Final Need column. Potential contributing factors to freight performance needs include roadway vertical grade, number of lanes, traffic volume-to-capacity ratios, presence/lack of a climbing lanes, and road closures. Also identify higher than average percentages of one or more closure reasons on any given segment